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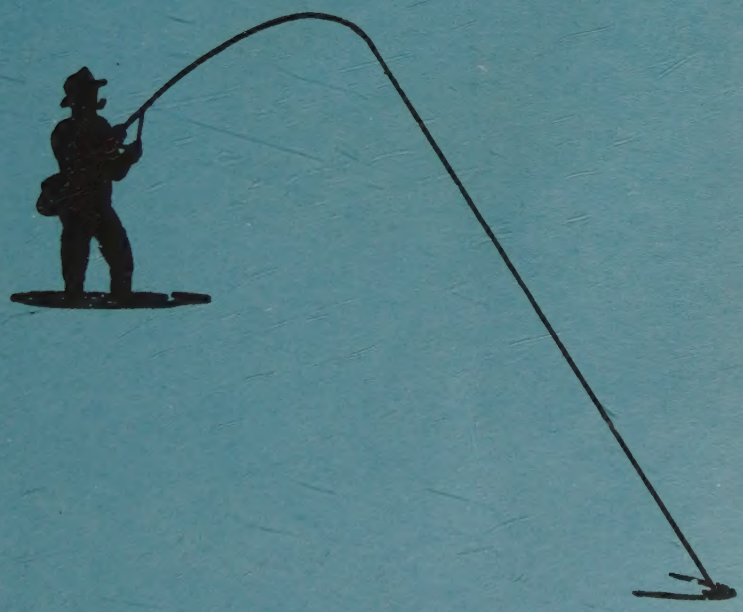
Sport Fishery Abstracts



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Sport Fishery Abstracts

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
Donald F. LaPointe, Editor
Geneva T. Thompson, Asst. Editor

3369. Needham, Paul R. 1959. NEW HORIZONS IN STOCKING HATCHERY TROUT. Transactions of the 24th North American Wildlife Conference, pp. 395-407.

A summary of over 244 separate planting experiments using marked trout made in the United States and Canada clearly demonstrate appallingly low survivals to creels. Stream plants of fingerling trout 1-4 inches in length, of all species, made at all seasons of the year, produced an average return of only 2.5 percent from 21 separate experiments. Lake plants of fingerlings did better, giving an average return of 7.4 percent from 32 experimental plantings. Stocking of catchable or legal-sized trout six inches and up gave the highest returns but at the greatest cost. In lakes the planting of catchables at all seasons produced a mean return of 34.5 percent and ranged from 88.4 down to 1.10 percent. Stream stocking of catchables made in advance of the opening of the fishing season, averaged 28.6 percent in numbers returned and they ranged from 82.0 percent down to 2.60 percent. Twenty-four of the 54 experiments in this group produced returns of less than 20 percent. Stocking of large catchable trout during the summer period of greatest angling intensity gave the highest return of 41.3 percent from 68 experiments and they ranged from 92.2 percent down to 1.00 percent. Because of excessive over-winter mortality, catchables stocked after the close of the angling seasons in late summer or fall gave negligible returns in the following years. Between 65 percent and 85 percent of most state fishery budgets are allocated for the propagation of trout while in California only about 30 percent of licensed anglers share in the catching of catchables. Natural selection has operated on brood stocks held in hatcheries to produce trout that are adapted for survival in the hatchery but which are genetic misfits in wild environments. Continual expansion of trout rearing operations at the expense of habitat improvement or basic research seems indefensible. (Auth. abst.)

3370. Royce, William F. 1959. ON THE POSSIBILITIES OF IMPROVING SALMON SPAWNING AREAS. Transactions of the 24th North American Wildlife Conference, pp. 356-366.

The very poor survival of Pacific salmon from natural spawning is noted and the several factors causing the deaths of eggs and larvae are considered. It is concluded that one of the most serious causes of mortality is dirty compacted gravel with poor circulation of water. It should be practical to create or improve salmon spawning areas. Research on this problem should have immediate benefits. (Auth. abst.)

3371. Byrd, I. B. 1959. ANGLING SUCCESS AND SEASONAL DISTRIBUTION OF CATCH IN ALABAMA'S STATE-OWNED PUBLIC FISHING LAKES. Transactions of the 24th North American Wildlife Conference, pp. 225-237

The construction of lakes by the Alabama Department of Conservation was initiated to provide fishing in those areas of the State having insufficient public fishing waters. The lakes were constructed on carefully selected sites so they could be fertilized and otherwise managed to provide high sustained yields of fish. The lakes were stocked with bluegill, redear sunfish and largemouth bass.

Twelve state-owned lakes containing 841 acres were open to fishing for 2 to 8 years providing a total of 4,286 acre-years of fishing. During this time the lakes provided a total of 695,282 fisherman-trips in which the fishermen caught a total of 2,530,182 fish weighing 746,598 pounds. The average annual number of fisherman-trips per acre for all lakes was 162.2 and the average annual catch per acre was 590 fish weighing 174.2 pounds. The lakes provided a year-round fishery with satisfactory seasonal distributions of catch. Although a larger total catch was taken during the spring and summer, the catch per fisherman-effort was somewhat higher during the fall and winter.

After an average first year catch of 223.9 pounds of fish per acre, the average yearly catch per acre remained relatively stable, varying from 144.5 to 179.0 pounds per acre for periods up to 8 years. (Auth. abst.)

3372. Lambou, Victor W. 1959. LOUISIANA IMPOUNDMENTS: THEIR FISH POPULATIONS AND MANAGEMENT. Transactions of the 24th North American Wildlife Conference, pp. 187-200.

Impoundments in Louisiana support an extensive sport fishery. There are 18 impoundments in Louisiana with an area of over 100 thousand acres. Most of these impoundments were built for recreational purposes. The soils of the areas where the impoundments are located are relatively infertile and are generally acid in nature. Due to the relative shallowness and clearness of the impoundments, submergent aquatics are extremely abundant and often interfere with sport fishing. Most of the impoundments are managed by local game and fish commissions. Fish populations in eight impoundments were sampled by rotenone. Standing crops of fish occurring in the impoundments were on the average, much lower than standing crops of fish occurring in other types of habitat in Louisiana. An average of 73 pounds of fish per acre was recovered from the impoundments, consisting of 59 pounds of non-predaceous fish and 14 pounds of predaceous fish. Predator-prey relationships appeared to be similar to those Swingle found in Alabama ponds. In the past, management procedures for the impoundments have consisted of the following: regulation of sport fishing, regulation of commercial fishing, stocking, building of fish ladders, spraying of water hyacinths with 2,4-D and fluctuation of water levels. It appears that controlled drawdowns of water levels offer the best possibility as a sport fishery management tool for the impoundments. (Auth. abst.)

3373. Tarzwell, Clarence M. 1959. POLLUTIONAL EFFECTS OF ORGANIC INSECTICIDES. Transactions of the 24th North American Wildlife Conference, pp. 132-142.

The use of the new organic insecticides has now reached a level at which they are becoming water pollutants. Kills of fish and other aquatic organisms have occurred in many areas throughout the country. By means of carbon filters, DDT has been recovered from several of our major stream systems. Bioassay studies carried out at the Robert A. Taft Sanitary Engineering Center have demonstrated that in general the chlorinated hydrocarbons are more toxic than the organic phosphorus insecticides and that their toxicity is not significantly influenced by water quality. Among the chlorinated hydrocarbons Endrin is most toxic having a TL_m value for bluegills of 0.6 ppb, while Guthion is the most toxic of the organic phosphorus compounds tested to date. The toxicity of these materials, especially the organic phosphates, differs widely for different species of fishes and it is impossible to judge the toxicity of these materials to all fishes on the basis of tests with one species. Further resistance and sensitivity are not consistent but vary with the species and the materials being tested. If certain of the less toxic materials such as BHC and Sevin and some of the organic phosphorus compounds which hydrolyze rapidly could be used for the control of agricultural and forest pests, the threat to fishes would be greatly reduced. All new materials should be tested to determine their toxicity to the aquatic biota before they are approved for wide scale application. Efforts should be directed toward the development of toxicants which are specific for the organisms it is desired to control. (Auth. abst.)

3374. Blanc, Maurice. 1958. STRUGGLE TO CONTROL ONCHOCERCASIS AND THE PROTECTION OF FISHERIES RESOURCES IN FRENCH OCCIDENTAL AFRICA. (LUTTE CONTRE L'ONCHOCERCOSE ET PROTECTION PISCICOLE EN A. O. F.) Terre et Vie 105(2):112-127.

Previous trials to control Simulium spp. with lindane in Mayo-Kebbi (Tchad, A. E. F.) were only temporarily effective and fish mortality was severe. In the laboratory 1 mg. lindane/l. water for 30 min. was sufficient to poison or even kill most of the native fishes, especially Cichilidae and Siluridae, which are economically very important. D. D. T. did not cause the first symptoms of poisoning in the most sensitive species until a concentration of 8 mg. /l., and 10 mg. /l. was needed to cause serious effects. A preliminary survey of the principal rivers of Haute-Volta (A. O. F.) collected 96 species of fishes, where only 17 species had previously been reported for the entire territory. All these local species tolerated 8 mg. D. D. T. /l. for more than 2 hours. A concentrated study of the Bougouri-Ba River collected 48 species of fishes, 31 of which are listed. The dry season is the preferable time of application of D. D. T. because: (1) the Simulium larvae are then localized in the intermittent regions of sufficiently rapid current, each of which can be effectively treated with larvicide separately; (2) the amount of river to be treated and the amount of D. D. T. required is thus less; (3) and the period of fish reproduction is usually then past. However, these advantages are offset by the apparent existence of a resistant stage of Simulium in the dry season, either resistant eggs or females in diapause, that are not affected by D. D. T. (R. M. C.)

3375. Cole, Charles F., and Finkelstein. 1959, A PRELIMINARY REPORT OF STANDING CROP AND RATES OF HARVEST IN LAKE FORT SMITH, ARKANSAS: 1957 THROUGH 1958. Proceedings of the Arkansas Academy of Science, Vol. XIII, 50-65.

A report on the preliminary examination of a small water supply reservoir providing foundation information for further studies designed to develop data for reservoir fishery management. (Auth. abst.)

3376. Holmes, P. F. 1960. THE BROWN TROUT OF MALHAM TARN, YORKSHIRE. The Salmon and Trout Magazine, No. 159, May 1960, pp. 127-145.

Malham Tarn Lake is described. Age and growth, "condition", spawning, food, parasites, and malformations of resident brown trout are discussed. Some angling records are noted.

3377. Robson, D. S. 1960. AN UNBIASED SAMPLING AND ESTIMATION PROCEDURE FOR CREEL CENSUSES OF FISHERMEN. Biometrics, Vol. 16, No. 2, pp. 261-277.

The sampling design described is constructed specifically to provide the data for an unbiased ratio-type estimate of total catch. Such a design will, of course, also provide the data for the unbiased estimation of total fishing effort and of the sampling error variance of the estimators. Disadvantages and limitations of the sampling and estimation procedure are discussed. (Auth.)

3378. Myers, George S. 1960. RESTRICTION OF THE CROAKERS (SCIAENIDAE) AND ANCHOVIES (ENGRAULIDAE) TO CONTINENTAL WATERS. Copeia, No. 1, March 25, 1960, pp. 67-68.

An important but unnoticed feature of the geographical distribution of the Sciaenidae is the strict confinement of the family to continental coasts. The plankton-feeding anchovies (Engraulidae), which, although abundant on southeast Asian continental coasts, are almost absent in Oceania. Moreover, in America, anchovies shun most of the oceanic islands that are poor in croakers, and swarm along coasts frequented by sciaenids.

Certainly it cannot be said that croakers and anchovies flourish on elements in the marine environment supplies only on coasts with many rivers; nor in areas where nutrients are derived from upwelling. Yet there must be some reason for their peculiar distribution.

3379. Hubbs, Clark, Murray J. Littlejohn, and Patricia G. Littlejohn. 1960. REDUCED SURVIVAL OF YOUNG ETHEOSTOMATINE FISHES AND HYLID TADPOLES DUE TO AMMONIA FUMES PRODUCED BY A RODENT COLONY. Copeia, No. 1, March 25, 1960, pp. 68-69.

Air-borne ammonia, produced by a rodent colony

in a laboratory room, killed darters in various lengths of time depending upon distance from the rodent colony and freshness of the rearing water which had become contaminated with dissolved ammonia.

3380. Massmann, William H. 1960. ADDITIONAL RECORDS FOR NEW FISHES IN CHESAPEAKE BAY. Copeia, No. 1, March 25, 1960, p. 70.

Observations of Etrumeus sadina, Trachurops lathami, Scomberomorus cavalla, Ammodytes americanus and Pollachias virens are recorded.

3381. Patten, Benjamin G. 1960. A HIGH INCIDENCE OF THE HYBRID ACROCHEILUS ALUTACEUM X PTYCHOCHEILUS OREGONENSE. Copeia, No. 1, March 25, 1960, pp. 71-73.

The abundance of Yakima River examples imply that the chiselmouth X squawfish hybrid is not as rare as past records indicate. They can easily be misidentified as chiselmouth by persons inexperienced in squawfish and chiselmouth characteristics. Investigators working in the lower Columbia River have reported a fish that appeared to be a chiselmouth X squawfish hybrid, but unfortunately none could be obtained to verify this identification.

3382. Hemphill, A. F. 1960. MARINE FISHES COLLECTED FROM INLAND STREAMS OF ALABAMA. Copeia, No. 1, March 25, 1960, p. 73.

Mullet, needlefish and hogchokers have been collected in streams 95 to 377 miles from the Gulf.

3383. Kramer, Robert H., and Lloyd L. Smith, Jr. 1960. UTILIZATION OF NESTS OF LARGEMOUTH BASS, MICROPTERUS SALMOIDES, BY GOLDEN SHINERS, NOTEMIGONUS CRYSOLEUCAS. Copeia, No. 1, March 25, 1960, pp. 73-74.

In the three-year period, 1956-1958, when samples of bass eggs were taken, it was found that four to 75 percent of the active bass nests in Lake George proper and 40 to 94 percent of those in an adjoining slough were used by golden shiners for egg deposition. The percentage of golden shiner eggs in nests used by shiners ranged from 0.6 to 78.4 percent of all eggs present.

Golden shiner reproduction was the greatest in successful bass nests, and the least successful in bass nests which failed to give rise to a brood. Shiner eggs laid in prepared but unused bass nests disappeared shortly after spawning. Abundance of young-of-year golden shiners, as determined from bag-seine catches during the summer, was directly proportional to the percentage of bass nests utilized for spawning in the spring.

3384. Wahl, Richard W. 1960. CHROMOSOME MORPHOLOGY IN LAKE TROUT SALVELINUS NAMAYCUSH. Copeia, 1960, No. 1, 11. 16-19.

Chromosome numbers are 2N = 84 in lake trout, 80 in the arctic charr, and 84 in the brook trout. Brook trout chromosomes are smaller than those of the arctic charr and lake trout. In each of the three species there are eight V-shaped pairs of chromosomes, the rest being rod-shaped. One small rod-shaped pair has a very long constriction with a satellite at the end. This pair has not been reported in any other salmonid that has been studied so far, although the smelt has a similar, though much smaller, constriction on a rod-shaped pair. Lake trout chromosomes, in particular, have one very long rod-shaped pair of chromosomes, differing from the other charrs in this respect.

Hybridization experiments and cytological evidence indicate that a close chromosome similarity exists among the charrs; closer even than among some members of the genus Salmo. (Auth. summ.)

3385. Clugston, James P., and Edwin L. Cooper. 1960. GROWTH OF THE COMMON EASTERN MADTOM, NOTURUS INSIGNIS IN CENTRAL PENNSYLVANIA. Copeia, 1960, No. 1, pp. 9-16.

The age was determined for 776 madtoms collected during the period from November 1957 to November 1958 by observing the growth pattern changes on the cross sections of their pectoral spines. Most of the fish collected were in age-groups I, II, and III with only a few in age-groups O and IV.

For the first two years the annual increments of growth in length averaged about 45 mm.; during their third and fourth years of life the increments decreased to about 20 mm. Most of the annual increment in growth occurred during a relatively short period: from June to September.

The maximum specific growth rate in weight of the madtom is high early in life, about 3.8 percent per day, and decreases with increasing age to approximately 0.5 percent per day. A very pronounced increase in specific growth rate occurs in the summer, following a very low rate for the winter months. Before sexual maturity is reached for both sexes, the specific growth rate is high during all the summer months. After sexual maturity is reached, the majority of the growth occurs after spawning in the months of July, August, and September. (Auth. summ.)

3386. Hubbs, Clark. 1960. DURATION OF SPERM FUNCTION IN THE PERCID FISHES ETHEOSTOMA LEPIDUM AND E. SPECTABILE, ASSOCIATED WITH SYMPATRY OF THE PARENTAL POPULATIONS. Copeia, 1960 No. 1, pp. 1-8.

Accidental fertilization by gametes swept from the spawning pairs is possible in fresh-water fishes. Darter eggs appear to have a selective factor that reduces the possibility of hybrids resulting from such current-swept gametes. A darter population allopatric to species with which the individuals can exchange genes has sperm which maintains its fertilization capacities longer. A darter population allopatric to species with which the individuals can hybridize has eggs which have lost the selective factor against foreign sperm. (Auth. concl.)

3387. Mather, Frank J., III. 1960. RECAPTURES OF TUNA, MARLIN AND SAILFISH TAGGED IN THE WESTERN NORTH ATLANTIC. Copeia, No. 2, June 29, 1960, pp. 149-151.

Tags from 5 bluefin tuna, 3 Atlantic sailfish, and

2 white marlin had been recovered up to the end of 1959. The most important result is the proof of the trans-Atlantic migration of 2 bluefin tuna. Next in importance is the return connecting the newly-discovered offshore wintering grounds for medium-sized bluefin tuna with their usual summering area off Cape Cod. The returns for marlin and sailfish are of value mainly in showing the survival of the fish and the holding power of the tags. These results suggest that the life span of the white marlin may be fairly long, as the species attains weights of over 100 pounds, and that adult Atlantic sailfish may be tagged with a reasonable chance of recapture. The probable movement of a white marlin from off Ocean City, Maryland, to off Habana, Cuba, is of great interest, but due to the unfortunate negligence of the tagger in failing to report the necessary data, this cannot be considered as entirely certain.

3388. Erdman, Donald S. 1960. LARVAE OF TARPON, MEGALOPS ATLANTICA, FROM THE ANASCO RIVER, PUERTO RICO. Copeia, No. 2, June 29, 1960, p. 146.

Another clue in the life history of the tarpon was revealed on September 27, 1959, when 11 larvae of this species from 24 to 26 mm. standard length were caught from the Anasco River, Puerto Rico. The tarpon were captured with a dip net near the surface in open river water about 300 yards above the actual river mouth (where it joined the sea).

3389. Franklin, Donald R., and Lloyd L. Smith, Jr. 1960. NOTES ON THE EARLY GROWTH AND ALLOMETRY OF THE NORTHERN PIKE, ESOX LUCIUS L. Copeia, No. 2, June 29, 1960, pp. 143-144.

During a study of the early life history of the northern pike, observations on early development and allometric growth relationships were made. Analysis of allometric growth using 90 fish between 25 and 115 mm. in total length was made. Included is a table of allometric growth of body regions and head regions in 90 fingerlings of the northern pike--expressed as percentage of head or total length in mm.

3390. Butner, Alfred and Bayard H. Brattstrom. 1960. LOCAL MOVEMENT IN MENIDIA AND FUNDULUS. Copeia, No. 2, June 29, 1960, pp. 139-141.

The number of marked Fundulus and Menidia returning to a stream in which they were tagged decreases from day to day. The rate of decline is faster in Menidia than in Fundulus. These differences are related to general swimming activity, schooling behavior, and feeding of the two species. We interpret these results not as homing, but a result of chance localization of activity. (Auth. concl.)

3391. Behnke, Robert J., and Ralph M. Wetzel. 1960. A PRELIMINARY LIST OF THE FISHES FOUND IN THE FRESH WATERS OF CONNECTICUT. Copeia, No. 2, June 29, 1960, pp. 141-143.

This list includes all fishes known to occur in the freshwaters of the state. Expected occurrences of several other species are noted.

3392. Sawyer, Philip J. 1960. A NEW GEOGRAPHIC RECORD FOR THE AMERICAN BROOK LAMPREY, LAMPETRA LAMOTTEI. Copeia, No. 2, June 29, 1960, pp. 136-137.

New record for Oyster River, Strafford County, New Hampshire and from Wednesday Brook, a tributary of this river.

3393. Macphee, Craig. 1960. POSTLARVAL DEVELOPMENT AND DIET OF THE LARGESCALE SUCKER, CATOSTOMUS MACROCHEILUS, IN IDAHO. Copeia, No. 2, June 29, 1960, pp. 119-125.

Except for the coiling of the intestine in the large-scale sucker, Catostomus macrocheilus, larval metamorphosis is complete in postlarvae about 20 mm. in fork length.

The length-weight relationships of post-larval and juvenile suckers are described by two straight logarithmic regression lines. The intersection of these lines coincides with the end of major changes in physiognomy and thus, could be useful as a criterion for designating the end of postlarval development.

Percentage frequency of occurrence for diatoms and protozoans was significantly higher in juvenile than in postlarval fish while that for rotifers and cladocerans was relatively uniform.

In general, the average number of diatoms and protozoans ingested per gram weight of fish was greater for juvenile than for postlarval suckers whereas the average number of rotifers and cladocerans eaten was considerably less for juvenile than for postlarval suckers.

A change in behavior from surface to bottom feeding is associated with a shift in the lower jaw of the mouth, whereas a behavioral change from discriminate to non-discriminate feeding is associated with the development of the coiled intestine. (Auth. summ.)

3394. Hughes, G. M. 1960. A COMPARATIVE STUDY OF GILL VENTILATION IN MARINE TELEOSTS. The Journal of Experimental Biology, Vol. 37, No. 1, pp. 28-45.

Movements of the lower jaw and operculum have been recorded simultaneously with the associated pressure changes in the buccal and opercular cavities during breathing of 13 species. In all species ventilation of the gills is achieved by the action of a buccal pressure pump and of opercular suction pumps. The time course of the pressure changes indicates differences in the relative importance of the two pumps which are related to the habitat of the fish. The suction pump becomes of greatest importance in fishes which spend most of their lives on the sea bottom. In several species the differential pressure curve does not include the brief period of reversal in pressure gradient found in most fishes so far investigated. Notable among these species are the two flatfishes investigated and in which there is some evidence for

an active opercular valve. In general, the results confirm the validity of Baglioni's classification of the respiratory mechanisms of teleost fishes. (Auth. summ.)

3395. Bainbridge, Richard. 1960. SPEED AND STAMINA IN THREE FISH. The Journal of Experimental Biology, Vol. 37, No. 1, pp. 129-153.

Measurements of the maximum speed sustained during bursts of swimming of up to 20 sec. duration by dace, trout and goldfish of various lengths are reported. The ability to sustain periods of swimming appears to be related differently to length in different species. In the dace it is proportional to $L^{1.09}$, in the trout and goldfish to $L^{0.65}$. The dependence of this relationship upon various factors is considered. It is concluded that allometric increase of muscle and the influence of an increasing Reynolds number, possibly combined with other, physiological factors could adequately account for the variation observed. The precise form of the speed/duration relationship differs in different species. These variations are also probably accountable for by a combination of different muscle percentages and fineness ratios together with other, physiological factors. The ability to maintain speed diminishes rapidly with increasing time interval in all the species measured. The maintained speed falls from about 10L/sec., maintainable for only 1 sec. of swimming, down to 5L/sec. for 10 sec. and further to a cruising speed of about 4L/sec. by 20 sec. The nature of this time/speed relationship is considered to be determined by the ability of the muscle to utilize stores of raw material and by the rates at which these can be supplied to, and waste products removed from, the muscle. A diagram showing the relationship between velocity of water flow and the maximum distance which various hypothetical fish could traverse in such currents is constructed; and possible applications of this information are briefly considered. (Auth. summ.)

3396. Parrish, B. B., I. G. Baxter, and M. J. D. Mowat. 1960 AN AUTOMATIC EGG COUNTER. Nature, Vol. 185, No. 4715, p. 777.

Eggs are drawn in a stream of water through a constricted tube, interrupting a beam of light which is directed through it. The light beam falls on the cathode of a photomultiplier tube, and the interruptions of the beam are recorded on an electronic counter. In practice, using herring eggs, a counting rate of 100 eggs per second was found to be best. Maximum error on known size samples did not exceed one percent.

3397. Srivastava, P. N. 1960. THYROIDAL CONTROL OF RADIOPHOSPHORUS METABOLISM IN YEARLING SALMON, SALMO SALAR L. Canadian Journal of Zoology, Vol. 38, No. 2, pp. 249-256.

In one experiment yearling Salmo salar L. treated with 0.3% thiourea for a fortnight absorbed 50.3% of P^{32} from the water whereas in control they could utilize only 40.1%. The uptake in various tissues (bone, liver, kidney, and muscles) was always more in treated fishes than in control. In a second experiment the utilization of radiophosphorus was minimum (39%) in control, more (52%) in thiourea-injected fishes, and maximum (63%) in thyroxine-injected ones. The turnover time of P^{32} was slower in control than the treated fishes. It is suggested that in the thiourea-treated fishes stimulation of the thyroid is indirect (by thyrotropin secreted by the pituitary gland) whereas in the thyroxine-injected fishes the stimulation is direct and so the P^{32} utilization is maximum. Thus the thyroid stimulates mineral metabolism. (Auth. abst.)

3398. Pomeroy, Lawrence R. 1960. PRIMARY PRODUCTIVITY OF BOCA CIEGA BAY, FLORIDA. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 10, No. 1, pp. 1-10.

The relative importance of turtle grass, phytoplankton, and the benthic microflora as primary producers was determined in Boca Ciega Bay, Florida. In water less than two meters in depth, which makes up 75 per cent of the bay, the three are about equally important. In deeper water only phytoplankton is significant. The methods used and the estimation of community production are discussed. (Auth. abst.)

3399. Voss, Gilbert L., and Nancy A. Voss. 1960. AN ECOLOGICAL SURVEY OF THE MARINE INVERTEBRATES OF BIMINI, BAHAMAS, WITH A CONSIDERATION OF THEIR ZOOGEOGRAPHICAL RELATIONSHIPS. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 10, No. 1, pp. 96-116.

The marine invertebrates of the shallow waters of Bimini, Bahamas, are listed with descriptions of the habitats. Numbers and vertical distribution of the species occupying the intertidal zone and above are given, together with their plant and animal associates. The hydrographic conditions on the Great Bahama Bank are briefly discussed in relation to the distribution of the invertebrates. The fauna is compared with that of Soldier Key in the Florida Keys and the possible origins of the two faunas are discussed. (Auth. abst.)

3400. Wieser, Wolfgang. 1960. BENTHIC STUDIES IN BUZZARDS BAY. II. THE MEIOFAUNA. Limnology and Oceanography, Vol. V, No. 2, pp. 121-137.

During the summer of 1957 a study of the small metazoans (meiofauna), based on a series of Phleger core samples, was undertaken at three stations in Buzzards Bay, Massachusetts. The number of animals ranged from 1.69×10^5 to $1.86 \times 10^6/m^2$, the dry weights varied from approximately 100 to 600 mg/m^2. The nematodes and kinorhynchs, which comprised between 89 and 99% of the total mieofauna, were studied in detail. The sandy localities were characterized by a number of nematodes restricted to this habitat. The locality rich in fine deposits was characterized by the relative abundance of several

nematodes. These "communities" can also be considered as two ecological groups of species, the former dependent on the presence of sand, the latter on that of fine deposits, which actually live side by side, forming an intricate meshwork of faunal combinations. Each combination is determined by the relative amounts of sand and fine deposits present.

The uniformity of the nematode fauna within each station was greater than that between two different stations. Most important in determining the degree of faunal uniformity between paired samples is the similarity in their silt-clay content. However, other mechanical factors also play a role.

An analysis of the total species composition of the nematode fauna revealed that Terschellingia longicaudata was the most abundant species at station R, whereas at the stations P and J there were three or four equally dominant species. This is interpreted as indicating a splitting up of the sandy habitat into subhabitats. The simultaneous occurrence of closely related species in this environment further supports the conjecture.

The distribution of "buccal types" amongst nematodes is correlated with the distribution of sediments. (Auth. abst.)

3401. Sanders, Howard L. 1960. BENTHIC STUDIES IN BUZZARDS BAY. III. THE STRUCTURE OF THE SOFT-BOTTOM COMMUNITY. Limnology and Oceanography, Vol. 5, No. 2, pp. 138-153.

A series of 24 samples was taken at periodic intervals at a single locality in Buzzards Bay from February 1956 to January 1958. With the exception of 4 samples which departed markedly from the others in regard to sediment composition, very high indices of faunal affinity were obtained within the series. The silt-clay fraction of the sediment in the 20 samples with high faunal indices varied from 78-91%, and when the contained species were ranked by abundance, the commoner species achieved approximately the same rank from sample to sample. Thus, 8 or 9 species are a constant part of the biological environment of this association, and there is an approximately constant numerical proportionality among them. Seventy-nine species were obtained from the 20 samples of typical sediment composition. However, 11 species comprised almost 95% of the total fauna by number while the lamellibranch Nucula proxima (58.86%) and the polychaete Nephthys incisa (17.21%) were commonest. Ten species make up 95% of the total biomass. Thus the community, both numerically and by biomass, is characterized by pronounced dominance of few species. The niches of the 9 most common species, representing 93.5% of the community by number, were categorized by method of feeding, kind of food and spatial distribution. Considering only these few factors, it was possible to demonstrate certain differences in niche preference. The relationship of animal numbers to animal weight revealed the expected pyramid of numbers with very few organisms in the largest weight categories and numerous individuals in the smaller weight groups. However, when the biomass within each weight category was determined, the expected inverted pyramid did not result. Numbers are considered more valid than biomass in quantitative benthic studies, since only 0.15% of the fauna constitute 55.17% of the entire weight. The presence or absence of a rare, randomly distributed large animal may alter the biomass of an individual sample by two orders of magnitude.

3402. Pickard, G. L., and L. F. Giovando. 1960. SOME OBSERVATIONS OF TURBIDITY IN BRITISH COLUMBIA INLETS. Limnology and Oceanography, Vol. 5, No. 2, pp. 162-170.

Measurements have been made by a light scattering method of the optical turbidity of the waters in some typical British Columbia inlets with depths to 700 m. (The optical turbidity here used is the extinction coefficient or fractional reduction in light intensity per meter length due to scattering.) The major contribution to the turbidity in the large inlets is the minerogenic material brought in by rivers. Therefore those inlets with rivers originating in glaciers exhibit the highest turbidity values and there is a marked seasonal variation. In the surface layers, values recorded for turbidity range from 0.2 m^{-1} in winter to 35 m^{-1} in summer with a marked decrease from head to mouth of the inlet. The main body of water in an inlet is usually fairly uniform in turbidity at 0.1 to 2 m^{-1}. (For comparison, double distilled water has a turbidity of 0.024 m^{-1} for light of wavelength 5460 Å in air.) Particle sizes average about 20μ diameter in summer and 8μ in winter, with little material less than 2μ in diameter. An increase in turbidity near the bottom is common and may be due to tidal currents but evidence suggests that turbidity currents originating at the inlet head may be common and contribute to the bottom water turbidity. (Auth. abst.)

3403. Gates, Jean A., and William B. Wilson. 1960. THE TOXICITY OF GONYAULAX MONILATA HOWELL TO MUGIL CEPHALUS. Limnology and Oceanography, Vol. 5, No. 2, pp. 171-174.

Laboratory experiments were conducted to determine the effects of in vitro cultures of the marine dinoflagellate, Gonyaulax monilata Howell, on fishes. Results indicate that the organism produced a substance(s) toxic to fishes and that the toxicity of the medium is increased if the dinoflagellate cytolyses. (Auth. abst.)

3404. Grzenda, Alfred R., and Morris L. Brehmer. 1960. A QUANTITATIVE METHOD FOR THE COLLECTION AND MEASUREMENT OF STREAM PERIPHYTON. Limnology and Oceanography, Vol. 5, No. 6, pp. 190-194.

Two methods for the collection and estimation of stream periphyton production are presented.

The periphyton was collected on 1.4 dm^2 plexiglass plates attached to a horizontal crossbar. The crossbar was supported by a vertical post driven into the stream bottom or supported by a concrete block. The plates were removed from the stream and the established population estimated by determin-

ing the absorbency of the ethanol-soluble phytopigments and by gravimetric procedures.

A reliable estimate of the population can be made from the phytopigment absorbency values if the latter are corrected for deviations from the absorbency:concentration relationship and if the substrata are removed from the stream before the growth is too profuse. Confidence limits are given for the phytopigment density: weight or organic material relationship. (Auth. abst.)

3405. Rawson, D.S. 1960. A LIMNOLOGICAL COMPARISON OF TWELVE LARGE LAKES IN NORTHERN SASKATCHEWAN. Limnology and Oceanography, Vol. 5, No. 6, pp. 195-211.

Five large lakes on the rocky Precambrian Shield of northern Saskatchewan are definitely oligotrophic. Five others on the glacial drift south of the Shield are clearly eutrophic and two across the boundary are intermediate. From the analysis of extensive data, five physical and three biological criteria have been selected which tend to agree in indicating the trophic nature and relative productivity of these lakes. (Auth. abst.)

3406. Shapiro, Joseph, 1960. THE CAUSE OF A METALIMNETIC MINIMUM OF DISSOLVED OXYGEN. Limnology and Oceanography, Vol. 5, No. 6, pp. 216-227.

Coincident with a condition of rapidly increasing eutrophication, Lake Washington, a large, deep lake, near Seattle, is exhibiting an increase in the magnitude of a metalimnetic depletion of dissolved oxygen. Possible causes of this depletion are examined, and the conclusion is that the respiration of a metalimnetic population of non-migrating copepods is the prime agent. Calculations are presented in support of this conclusion, and chemical properties of the notch are compared with those of a hypolimnetic notch due to morphometric causes, to provide further evidence. The recent increase in magnitude of the phenomenon is considered to be due to the increase in numbers of copepods. (Auth. abst.)

3407. Parker, Richard A. 1960. COMPETITION BETWEEN SIMOCEPHALUS VETULUS AND CYCLOPS VIRIDIS. Limnology and Oceanography, Vol. 6, No. 6, pp. 180-189.

Simocephalus vetulus and Cyclops viridis were raised in pure and mixed cultures under controlled laboratory conditions. Cyclops numbers were depressed markedly in the presence of Simocephalus, whereas Cyclops had essentially no influence on numbers of Simocephalus. (Auth. abst.)

3408. Blackburn, M. 1960. A STUDY OF CONDITION (WEIGHT FOR LENGTH) OF AUSTRALIAN BARRACOUTA, THYRSITES ATUN (EUPHRASEN). Australian Journal of Marine and Freshwater Research, Vol. 11, No. 1, pp. 14-41.

Regression of weight in the round (w) on length to caudal fork (l) was calculated for 6571 barracouta from southern Victoria and 2711 from south-eastern Tasmania. The equations for the regressions, which differ significantly in position but not in slope, are respectively $w = 0.0572\, l^{2.260588}$ and $w = 0.1064\, l^{2.238524}$ The values of the exponents are unusually low.

A condition factor K_n was obtained for each fish by dividing the observed weight by the weight estimated from the regression, and geometric mean K_n was calculated for each month for each of the two regions. The mean for southern Victorian fish varied within the year in much the same way in each of three successive years, with three highs and three lows from early spring through early winter, but was consistently higher in 1950-51 than at the corresponding period of the year in 1949-50 or 1951-52. A similar pattern of within-year variation is suggested by the scantier data for other years, and likewise for south-eastern Tasmanian fish. All changes in mean K_n are closely paralleled by those in mean $K_{n,c}$, the corresponding factor for beheaded eviscerated fish. It is also shown that changes in density of the fish are negligible. Thus the rises and falls in mean K_n represent true increments and decrements of growth in weight and volume of trunk muscle (edible flesh), unassociated with growth in length.

There is a tendency for fish with filling gonads to have better condition than ripe, spent, recovering, or immature individuals, but it does not explain the major part of the variation in condition observed. Neither is there any apparent relationship between K_n and percentage of the monthly sample affected by the sporozoan Chloromyxum or the cestode Tetrarhynchus, which cause the conditions known as "milky" and "wormy" and are the only parasites of barracouta that occur in the trunk musculature. It seems most likely that the changes in mean K_n signify a complex interplay between assimilation on the one hand and the energy demands of migratory and food-seeking activity on the other. (From auth. summ.)

3409. Kuroki, Toshiro, and Koji Nozawa. 1960. STUDIES ON THE WATER BOTTLE FOR CONTINUOUS SAMPLING AND ON ITS UTILITY - I. THEORETICAL IDEA AND PRACTICAL POINTS FOR WATER SAMPLING. Memoirs of the Faculty of Fisheries Kagoshima University, Vol. 8, pp. 101-110.

In the investigation of marine phenomena on a bay or inshore where water temperature, salinity and etc. are changing with the tide, an instant water sampling by reversing bottle may show the only datum on one point at that instant. The datum is not always a typical value in the point. Then, data of many samples are needed to get the average value correctly.

The authors projected the apparatus to sample sea-water continuously for a long time (12-36 hours) by means of laminar flow in a capillary.

They examined various types of water bottles. The bubbleless water bottle can be used even in rough sea, and, in spite of the decreasing of pressure head, this bottle will be the most useful in the point of its reliability. (From auth. abst.)

3410. Kuroki, Toshiro. 1960. BIOPHYSICAL

STUDIES ON THE AUDITORY CHARACTERISTIC OF FISH - II. DIRECTIONAL AUDIBILITIES IN VARIOUS TYPES OF LATERAL LINE. Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 8, pp. 89-100.

In this paper, the author investigated the relation between a directional audibility and a lateral line shape of fish. He assumed geometrically the seven types of lateral line shapes: (1) linear type, (2) interrupted linear type, (3) semicircular and linear type, (4) stepped linear type, (5) parallel type, (6) horse-mackerel's (Trachurus') type, (7) general type.

The maximum value of the most sensible frequency is 5200 - 8700 c/s, in the vertical direction. The minimum value of the one is 112 - 130 c/s in the direction of body axis (a bit upward frontally in some types). The stronger sound, however, shall not be equal to this frequency (may be lower). The directional angle of audibility for 200 - 300 c/s sound is very broad. This means that this (200 - 300 c/s) sound may be serious for fish in these conditions. Among these seven types of lateral line, the directional audibility of semi-circular and linear type is the most splendid and broadest; on the other hand, the one of simple linear type is very poor and narrow. (From auth. abst.)

3411. Saitō, Kaname, Muneo Sameshima, and Tomio Hemmi. 1960. XI. STUDIES ON THE RADIOLOGICAL CONTAMINATION OF SEA WATER, PLANKTONS AND FISHES IN THE WESTERN REGION OF THE NORTH EQUATORIAL CURRENT DURING THE PERIOD FROM 1958 to 1959. Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 8, pp. 181-193.

In this paper, we dealt with the inspection of radioactivity on the sea water, plankton and fishes, obtained from the North Equatorial Current and Kuroshio Current region, during the period from July 1958 to August 1959. The results obtained were summarized as follows: (1) The radiological contamination of sea water and planktons, collected at the region from longitudes 127 E to 142°E and from latitudes 6 N to 18N, has been recognized from July to September 1958. (2) During the period from September 1958 to August 1959, most of the inspected fish, caught at the southern sea region of Kagoshima Prefecture, were contaminated by radioactivity. (3) The radioactivity in the kidney of Istiophorus orientalis was mainly attributable to the radioelements of Group II. Group II, separated directly from the raw ashes of the kidney, or from the radioactive fraction obtained by ion exchange resin, was fractionated further into each member. Radioactive elements contained in Group II were proved to be mostly composed of Cd fraction. From the results of aluminium absorption curve and decay curve, the nuclide in question was identified as $^{113\,m}$Cd ($^{115\,m}$Cd). In the kidney, ^{59}Fe (^{55}Fe) and ^{65}Zn were confirmed together with $^{113\,m}$(Cd) ($^{115\,m}$Cd). (4) The quantity of radioactive nuclides in 100 g. of the kidney was calculated as follows: $^{113\,m}$Cd ($^{115\,m}$Cd) 0.09 μc, ^{59}Fe (^{55}Fe) 0.09 μc and ^{65}Zn 0.006 μc. (Auth. abst.)

3412. Enami, Sumio. 1960. STUDIES ON BUBBLE-NET - I - DRIVING AND INTERCEPTING EFFECT ON SOME FRESH-WATER FISHES. Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 8, pp. 140-144.

In order to see the driving and intercepting effects on goldfish and killifish some laboratory experiments on bubble-net, prepared with air bubble jets were done, the fact was confirmed that each of the two species was to be prevented from easy crossing through a bubble-net. Moreover it was ascertained that these effects were under the influences from the air-amount of the bubble net and from the space length between bubble holes. The intercepting effects, when compared to each other in the case of killifish and that of goldfish, were proved to be rather weak in the former, and strong in the latter. (Auth. abst.)

3413. Hartman, Richard T., and J. Herbert Graffius. 1960. QUANTITATIVE SEASONAL CHANGES IN THE PHYTOPLANKTON COMMUNITIES OF PYMATUNING RESERVOIR. Ecology, Vol. 41, No. 2, pp. 333-340.

A study was made of seasonal variations in size and species composition of phytoplankton communities from 5 collecting stations in the highly productive Sanctuary Lake portion of Pymatuning Reservoir. Values for suspended organic materials concentrated by triple centrifugation ranged from 38.2 mg per liter to 3.6 mg per liter over a 14 month period.

General agreement was found between values for suspended organic materials determined by gravimetric procedures and for total cell numbers. Suspended inorganic materials were highest in the northern end of the lake where Linesville Creek contributes relatively high amounts of silt.

Community composition was essentially uniform among the 5 collecting stations over the period of the study with the exception of the communities developed under an ice cover. Here considerable variation was observed among the 5 sampling stations. It is suggested that these differences in community structure are a result of the interference of the ice cover with the normal mixing of the waters from the two distinct drainage areas.

Dominant species are listed for 5 seasonal phytoplankton communities. Summer communities are dominated by colonial Cyanophyta, spring and fall communities by Chlorophyta, and the winter community by combinations of Diatomaceae and Chlorophyta. (Auth. summ.)

3414. Heath, James P. 1960. PENETRATION OF FRESH WATER THROUGH TWO OCEANIC STREAM BARS. Ecology, Vol. 41, No. 2, p. 381.

The homing of anadromous fishes has been presumed to be chemically influenced by the specific constituents of parent streams. However, the ability of some species to "home" in the apparent absence of an available home stream stimulus has been noted by various authors. The presence of fish off the entrance

of a stream with the ocean bar intact has suggested that other mechanisms might be involved.

An investigation was made to determine whether chemical differences might exist off the oceanic bars of two previously studied streams such that the gathering of steelhead and salmon could be accounted for by these differences.

The point of significance was that at Scott Creek, the seepage through the bar was sufficient to provide an actual local difference in the salinity of the sea itself. Waves sampled in the vicinity of the bar gave a salinity of 33.07 °/oo while samples of the waves taken upwind (up-current) gave 36.60 °/oo (Nov., 1958), Waddell Creek at this same date had seepage waters flowing out of the bar at low tide with a salinity of 26.39 °/oo.

It would appear that it is not necessary to postulate "guideposts other than odor" as Hasler claimed on the basis of the work of Shapovalov and Taft. Long before the bar breaks, there must certainly be plenty of chemical influence in the adjoining sea such that the concentration of fish in preparation for the opening is explainable on this basis. (Auth.)

3415. Goldman, Charles R. 1960. PRIMARY PRODUCTIVITY AND LIMITING FACTORS IN THREE LAKES OF THE ALASKA PENINSULA. Ecological Monographs, Vol. 30, No. 2, pp. 207-230.

The C^{14} technique was utilized for both bioassay of nutrient limiting factors and direct measurement of primary productivity in Brooks, Naknek, and Becharof Lakes. The efficiency of counting radioactivity was based on conversion of plankton to CO_2, thereby eliminating problems of geometry and self-absorption. (From auth. summ.)

3416. McNulty, J. Kneeland, Ernest S. Reynolds, and Sigmund M. Miller. 1959. ECOLOGICAL EFFECTS OF SEWAGE POLLUTION IN BISCAYNE BAY, FLORIDA: DISTRIBUTION OF COLIFORM BACTERIA, CHEMICAL NUTRIENTS, AND VOLUMES OF ZOOPLANKTON. Transactions of the Second Seminar on Biological Problems in Water Pollution, April 20-24, 1959, U. S. Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati 26, Ohio, 14 pgs.

Ketchum's Intertidal Volume Concept is applied to the distribution of coliform bacteria in Biscayne Bay, Florida. Due to irregularities of shoreline and bathymetry, segment boundaries follow section contours based on the observed mean excursion of a particle of water in the flood tide. The resulting segmentation pattern is interpreted to mean that river water in the main ship channel is flushed from the bay in roughly 7 to 9 days and in other parts of the bay where flushing occurs at all in roughly 8 to 11 days. Application of the theory to coliform bacterial distribution accounts for an average MPN decrease of almost 98%. The final predicted MPN is about 4 times higher than the observed value. Data on chemical nutrients, plankton volumes and water color are presented and discussed. (Auth. abst.)

3417. Loesch, Harold. 1960. SPORADIC MASS SHOREWARD MIGRATIONS OF DEMERSAL FISH AND CRUSTACEANS IN MOBILE BAY, ALABAMA. Ecology, Vol. 41, No. 2, pp. 292-298.

The Mobile Bay jubilee, in which crabs, shrimp, some fish, and other estuarine types crowd to the edge of the water at infrequent intervals during summer months chiefly along the northeast shore, occurs most frequently during the dark hours on a rising tide following a day of east wind. The coincidence of these climatological conditions results in an inshore movement of water which is low in O_2 because of the rotting of wood debris accumulated from the Tensaw River runoff from a deep pocket near the eastern shore of the bay. Demersal animals especially move inshore ahead of this water mass. Changes in tide, wind, or other meteorological conditions result in water aeration and terminate the jubilee. Mortalities are rare. (Auth. summ.)

3418. Wohlschlag, Donald E. 1960. METABOLISM OF AN ANTARCTIC FISH AND THE PHENOMENON OF COLD ADAPTATION. Ecology, Vol. 41, No. 2, pp. 287-292.

Metabolic characteristics were determined for Trematomus bernacchii, which is an antarctic benthic species living at year-round temperatures of -1.8° to 1.9° C. Metabolism was measured on the basis of oxygen uptake rates of fish confined to a closed chamber.

From a comparison of selected data on metabolism of warm eurythermal through cold stenothermal species, there appears to be an attenuation of the seasonal metabolic range as species are progressively cold adapted. The metabolic range attentuation occurs by virtue of the increase in metabolic levels at the lower natural environmental temperatures due to cold adaptation and by virtue of the retention of the same general upper level at upper environmental temperatures even though these maxima decline from warm to polar environments.

Questions are raised as to the possibility that polar species may have a greater efficiency of energy conversion into growth and to the possibility that the methanisms of cold adaptational control of metabolism may be applied to increase the growth of warm eurythermal species at low temperatures. (Auth. summ.)

3419. Shaw, Evelyn. 1960. THE DEVELOPMENT OF SCHOOLING BEHAVIOR IN FISHES. Physiological Zoology, Vol. XXXIII, No. 2, pp. 79-86.

The development of schooling behavior in Menidia is described. Schooling was observed in the laboratory and found to develop gradually, following characteristic patterns of approach and orientation. Schooling development was also observed under natural conditions. Fry 7-10 mm. in length were not found in schools, whereas many schools of fry over 12 mm. in length were found. Visual attraction develops gradually, paralleling the appearance of schooling. Current is not a necessary stimulus to orientation within a school Four fry reared in "isolation" joined a school. The significance is discussed. The significance of experience in the approach of fry to each other and in orientation within

the school is discussed. (Auth. summ.)

3420. Delco, Exalton A., Jr. 1960. SOUND DISCRIMINATION BY MALES OF TWO CYPRINID FISHES. The Texas Journal of Science, Vol. XII, Nos. 1, 2, pp. 48-54.

It is concluded that males of N. lutrensis and N. venustus demonstrate a positive approach reaction to female calls of their respective species, and that the effective discrimination by the males, even when simultaneously offered calls of the other species, operates as an important sexual isolating mechanism. (Auth. concl.)

3421. Buss, Keen, and Raymond McCreary. 1960. COMPETITIVE SURVIVAL ABILITY OF BROOK, BROWN, AND RAINBOW TROUT FINGERLINGS IN A STREAM-FED RACEWAY. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 99-102.

An experiment was designed to test the ability of hatchery-reared brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), and rainbow trout (Salmo gairdneri) to survive when in competition with one another. Twenty thousand fingerlings of each species were placed in an earthern raceway 1/2 mile in length. The water supply of this raceway was from a trout stream. For 1 year these fish were not fed. At the end of this period, the fish were removed and the species were separated, counted, and weighed. Rainbow trout were the most numerous, but many were emaciated. Half as many brown trout as rainbow trout were recovered, but the brown trout were in good condition and showed the best growth. Survival of brook trout was negligible. (Auth.)

3422. Cope, Oliver B. 1960. COLLECTION AND PRESERVATION OF FISH AND OTHER MATERIALS EXPOSED TO PESTICIDES. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 103-108.

The growing numbers of studies on pesticides and fish make it necessary for fishery biologists to adopt some specialized methods for collecting and preserving water, fish, bottom sediments, and aquatic vegetation. This is necessary because specialists in other fields, such as chemistry and histology, require some precise treatment of samples in order to provide accurate work in residue analysis and in interpretation of histological changes.

Fish can be collected by any means other than chemical. Fish for chemical analysis should be frozen; those for histological studies should be fixed in Bouin's or some other good fixative. Water samples for chemical analysis should be taken in glass containers, not in plastic. Aquatic vegetation can be collected by conventional methods and preserved by freezing in polyethylene bags. Aquatic invertebrates can be collected by any means other than chemical, and preserved by freezing in polyethylene bags. Bottom sediments should be collected in thin layers and preserved by freezing in polyethylene bags. (Auth.)

3423. Sneed, Kermit E. 1960. HORMONE SPAWNING OF WARM-WATER FISHES: ITS BIOLOGICAL AND PRACTICAL SIGNIFICANCE. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 109-113.

The use of gonadotrophins to induce spawning has many advantages in the culture of sport, food, bait, and tropical fishes. Also, it can make available large numbers of genetically similar, equal-aged test animals for radiation, cancer, pollution, and genetic studies.

Although the use of hormone-induced spawning has progressed in the last 25 years, the biological implications suggested by that work have been largely neglected. The literature implies, however, that there is less specificity in the pituitary hormones of fishes and other vertebrates than previously supposed, that there may be a seasonal difference in the biological effect produced by the pituitary of fishes, and that there is little or no qualitative difference in the pituitary hormones of the male and female fish. Confirmation of these generalities is limited by the lack of good bioassay methods for gonadotrophins from fish and other animals.

Future progress in the use of gonadotrophins will be limited until adequate basic research has been completed. Such basic research could provide information of value to all vertebrate endocrinologists, as well as permit fishery investigators to apply the theories advanced by endocrinologists. (H. K. D.)

3424. Allison, Leonard N. 1960. "SUNBURNING" FINGERLING LAKE TROUT WITH ULTRA-VIOLET LIGHT AND THE EFFECT OF A NIACIN-FORTIFIED DIET. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 114-116.

For a number of years at the State Fish Hatchery at Marquette, Michigan, a "bald" spot has developed on the top of the head of fingerling lake trout (Salvelinus namaycush) in their second summer. The fish are held indoors in troughs during the first year and transferred to outdoor raceways when they are about one year old. By the end of July about 20% of the fish are affected, but the lesions begin to disappear in August and are completely healed by the end of September. Mortality is above normal but not high; growth is retarded to some extent. One-year-old lake trout fingerlings were exposed to a sunlamp to determine whether the condition was caused by sunlight. Also, some fish fed a complete diet fortified with niacin up to eight times the normal daily requirement were exposed to the sun lamp to demonstrate the effect of a niacin-fortified diet. Definite symptoms of sunburn were induced in all groups of fish exposed to the sun lamp. Although the symptoms were delayed and disappeared more quickly than among the control fish, addition of niacin to the diet did not prevent appearance of the symptoms. Several groups of lake trout fingerlings held all summer in cement tanks in the building (where they were completely protected from sunlight) did not develop sunburn symptoms. Fish of the same age held in outdoor raceways during the same period developed the symptoms. Covers on the raceways to shade fish from direct sunlight (from May 15 to July 31) and water deeper than the 24 inches

used at Marquette may help to prevent sunburn. (Auth. abst.)

3425. Panikkar, Bhaskara M. 1960. LOW CONCENTRATIONS OF CALCIUM HYPOCHLORITE AS A FISH AND TADPOLE POISON APPLICABLE FOR USE IN PARTLY DRAINED PONDS AND OTHER SMALL BODIES OF WATER. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 117-120.

Toxic effect of calcium hypochlorite on green sunfish (Lepomis cyanellus), goldfish (Carassius auratus), black bullhead (Ictalurus melas), golden shiners (Notemigonus crysoleucas), and bullfrog tadpoles (Rana catesbiana) was determined in tap water and pond water. Values of available chlorine were lower in pond water than in tap water. The poisoning effect of calcium hypochlorite was less at lower temperatures than at normal temperatures. Golden shiners were more susceptible to calcium hypochlorite than other species of fish studied. For total removal of fishes and tadpoles, 16.0 ppm of calcium hypochlorite (which yields 30% of its weight in gaseous chlorine)is required. The high cost limits its use to small bodies of water. (Auth. abst.)

3426. Gebhards, Stacy V. 1960. BIOLOGICAL NOTES ON PRECOCIOUS MALE CHINOOK SALMON PARR IN THE SALMON RIVER DRAINAGE, IDAHO. Progressive Fish Culturist, Vol. 22, No. 3, pp. 121-123.

Precocious sexual maturity in chinook salmon parr is prevalent throughout the Salmon River drainage. On the Lemhi River, precocious development was found in 2.6% of the juvenile population. Both young-of-the-year males and yearling males were sexually mature. Although young-of-the-year males may not die after spawning, evidence indicated that the yearling males die after spawning. Observations of these fish on the spawning grounds suggest that they may perform the same function as the adult males during spawning. The precocious males are in constant attendance with the adult females and may play an important role in the overall fertilization of the eggs. (Auth. abst.)

3427. Frankenberger, Ludwig. 1960. APPLICATIONS OF A BOAT-RIGGED DIRECT-CURRENT SHOCKER ON LAKES AND STREAMS IN WEST-CENTRAL WISCONSIN. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 124-128.

This paper describes the construction of a boat-rigged d.c. shocker. The unit is effective in turbid and in densely vegetated water. Positive and negative electrodes are suspended from hollow fiberglass booms attached to the gunwales of a flat-bottomed boat. Fish caught in the electrical field are attracted to the positive electrode, which is suspended just below the surface of the water between the negative electrodes and the front of the boat. The results of seining and shocking in walleye rearing ponds indicate that shocking may be an effective method of cropping walleye fingerlings. This boom shocker is effective on almost all species of fresh-water fish common to the Midwest. (Auth. abst.)

3428. Houser, Alfred. 1960. A COLLAPSIBLE NYLON FISH TRAP FOR POND SAMPLING. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 129-133.

Cylindrical wire fish traps have been a standard means of sampling ponds and small lakes in Oklahoma for the last decade. New collapsible nylon nets were constructed, and their efficiency was compared with that of the wire traps. Traps of two diameters and traps with and without fingers in the throat were also compared. Details for construction of a nylon trap are given, and its advantages over the wire models are discussed. (Auth. abst.)

3429. Rupp, Robert S., and Stuart E. DeRoche. 1960. USE OF A SMALL OTTER TRAWL TO SAMPLE DEEP-WATER FISHES IN MAINE LAKES. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 134-137.

A small otter trawl which can be towed by an outboard boat and which is suitable for capturing small fish in fresh-water lakes is described. Methods of operating the net are discussed. Figures which give details of the construction and rigging of the trawl are included. (Auth. abst.)

3430. Franklin, Donald R., and Lloyd L. Smith, Jr. 1960. A UNITIZED SYSTEM OF WATER-LEVEL AND FISH-POPULATION CONTROL STRUCTURES FOR SPAWNING SLOUGHS. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 138-140.

Structures designed to regulate water levels and fish movements in a shallow spawning slough are described.

3431. Buck, D. Homes, and Maurice Whitacre. 1960. A NEW METHOD AND A NEW MATERIAL FOR SCREENING FISH. Progressive Fish-Culturist, Vol. 22, No. 3, pp. 141-143.

A floating-type filter box for screening fish eggs and small fry, to prevent contamination of experimental fish ponds, is described. The box operates in a partly submerged position. Water enters the box through a tube attached to the line supplying water to the pond. Water outside the box tends to equalize the pressure on the screen so that screened water filters out under reduced pressure. The unit has been operational for 18 months and has screened up to 6 acre-feet of water, at flows of 500 to 800 gpm, without servicing or cleaning. (Auth. abst.)

3432. Hayes, Murray L. 1959. BIOLOGICAL EFFECTS OF HEXADECANOL USED TO SUPPRESS WATER EVAPORATION FROM RESERVOIRS. Final Report submitted to the United States Bureau of Reclamation, March 1959, 98 pgs.

A study of some of the biological effects of hexadecanol used to suppress water evaporation from reservoirs has been made at Colorado State University under contract with the United States Bureau of Reclamation.

Hexadecanol was applied to four different ponds over the period of the study using wire mesh rafts and hand application. Dosage ranged from 0.118 pounds

per acre per day on Pond H1 to 0.930 pounds per acre per day on Pond 2.

Over all it might be said that most biological effects of hexadecanol are small in magnitude and well within the range of natural variation. However, one effect, that of surface tension reduction is large. Members of the biota dependent upon support of the surface film at some stage in their life history may be adversely affected.

3433. Burenkov, I. I. 1959. ON THE CAUSES OF THE MARKED DECLINE IN KAMCHATKA SALMON POPULATIONS. (O PRICHINAKH ZNACHITELNOVO SNIZHENIIA CHISLENNOSTI KAMCHATSKIKH LOSOSEI). Fisheries Research Board of Canada, Translation Series No. 262.

The causes of this decline are fully apparent - the effect of the intensive catching of salmon in the sea, carried on by the Japanese fishing fleets. The basis for this lies in the fact that a great many drift nets are operated right in the migration path of the salmon proceeding, for spawning, to the mouths of the rivers. Last year the total length of nets amounted to several thousand kilometres. As a result, a large part of the adult run did not reach the Kamchatka coast and that portion which did successfully get to the home streams was to such a degree damaged by the fine nylon thread of the nets that many perished without spawning.

The number of such damaged fish increases proportionately with the increase in intensity of sea fishing. Thus, for example, in 1954, only the occasional damaged fish was observed in the spawning runs but in 1958, they amounted to 15-20% of the whole population and in some rivers constituted even as much as 50%. Such a simultaneous catastrophic drop in the total abundance of spawning runs could not be attributed to the activity of the volcanoes in Kamchatka, even if they were all to have begun to erupt at one and the same time.

3434. Wuhrmann, K. 1959. CONCERNING SOME PRINCIPLES OF THE TOXICOLOGY OF FISH. (SUR QUELQUES PRINCIPES DE LA TOXICOLOGIE DU POISSON). Fisheries Research Board of Canada, Translation Series No. 243.

By numerous experimental examples we have shown that the poisoning of fish by some substances frequently encountered in waste waters depends in large measure on conditions in which the toxic solutions act on the test fish. Only the relation between the concentration and response time is a measure characterizing a fish poison. This relation is changed when one varies the test conditions. The factors of particular importance are: the species of fish, the pH, the temperature and the oxygen tension in the toxic solution. The age of the fishes seems likewise to play a certain role. We have explained the problem of the standardization of the toxicity-test for fish and make certain suggestions on the establishment of rules for testing. (Auth. summ.)

3435. Smirnov, A. I. 1959. THE EFFECT OF MECHANICAL AGITATION ON DEVELOPING EGGS OF THE PINK SALMON ONCORHYNCHUS GORBUSCHA (WALBAUM) SALMONIDAE. (VLIIANIE MEKHANICHESKIKH VOZDEISTVII NA RAZVIVAIUSHCHUIUSIA IKRU GORBUSHI ONCORHYNCHUS GORBUSCHA (WALBAUM) SALMONIDAE. Fisheries Research Board of Canada, Translation Series No. 231, from Doklady Akademii Nauk SSSR, Vol. 7, No. 2, pp. 365-368. 1954.

Repeated experiments with the eggs of different Far Eastern salmon did not reveal a rise in sensitivity of eggs to mechanical action just before hatching. These findings confirm also tests of the successful transfer of pink and coho eggs from Sakhalin to Moscow, undertaken just prior to hatch of the embryos.

Not being able in a short paper to report on the material collected for the other species of salmon, we may say only that the eggs of pinks and especially cohos, at the various stages of development, were appreciably more sensitive to the same degrees of mechanical agitation, than the eggs of autumn chums. (Auth.)

3436. Lindroth, Arne, and Eva Bergstom. 1959. NOTES ON THE FEEDING TECHNIQUE OF THE GOOSANDER IN STREAMS. Fishery Board of Sweden, Institute of Freshwater Research, Drottningholm, Report No. 40, pp. 165-175.

Ducklings of the goosander without mother bird were observed in a stream tank. As assumed from earlier stomach content analyses the birds practised active search after hiding bottom fishes among pieces of gravel and stones even without the optical stimulus of living or dead food fishes. Whether this is an innate behaviour or learned could not be stated. The role of mergansers in depressing the salmon parr populations towards an absolute survival level is briefly discussed. (Auth. summ.)

3437. Krokhin, E. M. 1959. DETERMINATION OF THE DAILY FOOD RATION OF YOUNG SOCKEYE AND THREE-SPINED STICKLEBACK BY THE RESPIRATION METHOD. (OPREDELENIE SUTOCHNYKH PISH CHEVYKH RATSIONOV MOLODI KRASNOI I TREKHIGLOI KOLIUSHKI RESPIRATSIONNYM METODOM.) Fisheries Research Board of Canada, Translation Series No. 209, from Izvestiia Tikhookeanskovo Nauchno-issledovatelskovo Instituta Rybnovo Khoziaistva i Okeanografii, Vol. 44, pp. 97-110, 1957.

The respiration method of estimating the food consumption of young sockeye and adult sticklebacks is described, based on a determination of the rate of exchange (of oxygen) and a calculation of the quantity of food, which is equivalent to that which results from the exchange in energy loss.

A comparison of the annual consumption by underyearlings and yearlings indicates that the latter consume four times as much food. Since the return from the sea of descending yearlings and two-year-olds is practically the same, the food resources of the nursery waters could be used much more rationally under conditions when young sockeye would be reared only to average of one year. When this is taken into consideration there is no advantage in rearing young sock-

eye under artificial conditions beyond the migrating yearling stage.

It was found that the daily ration of fingerling sockeye, expressed as a percentage of body weight, varied from 1.5% in winter to 11.3% in summer; for yearlings, the upper limit of variation was lower - 7.6%. The average yearly ration of young sockeye amounts to around 5% of the weight. The daily ration of adult sticklebacks varied from 1.8 to 5.1%, with an average yearly ration of 2.7%.

The annual consumption of food of young sockeye and sticklebacks amounts to approximately 8-9 times their final (end) weight, which is typical for plankton-eating fish.

The daily food ration, based on the present method, is found to be in accordance with the findings by other methods. The proposed method is the one preferred: it requires, for application, less material, less work and gives more stable and reliable results.

Knowledge of the food consumption of young sockeye and sticklebacks makes it possible to explain the complex relationship between the number of zooplankton consumers in the lakes, the abundance of plankton and the hydrobiological conditions in different years and various seasons of the same year. (Auth. concl.)

3438. Alm, Gunnar. 1959. CONNECTION BETWEEN MATURITY, SIZE, AND AGE IN FISHES. Fishery Board of Sweden, Institute of Freshwater Research, Drottningholm, Report No. 40, pp. 5-145.

At the Kälarne Fishery Research Station a great number of experiments have been carried out with different species and forms of fish, the aim being a study of the connection between first sexual maturity, size (growth rate), age, and longevity.

Within a certain experiment (a certain year class) and in specimens of the same age maturity is reached earlier by larger than by smaller specimens.

The comparison between different experiments (different year classes and populations with year classes of the same growth rate) reveals different cases.

The age for maturity can be genetically determined in different species and also in different forms of the same species. It is then usually higher in large-sized and often fast-growing forms than in small-sized and often slow growing ones. This is exemplified by big and small forms of trout, and perhaps also by similar forms of char and whitefish.

In different experiments or in different populations of the same species or form the age for maturity depends mainly on size, thus indirectly the growth rate. Acceleration of the metabolic processes can bring out maturity at a relatively low age and small size. Probably also environmental conditions, especially temperature, can exert a certain influence upon the age for maturity. High temperature then produces a lower, low temperature a higher age for maturity. The frequently occuring statements in literature about a decreasing of the growth rate by the process of maturation have been discussed. On the basis of the experiments this has been shown not to apply to wild living fishes in any higher degree.

It has furthermore been shown that in a certain experiment the early mature specimens were as a rule such as had shown a good growth rate throughout their life, while specimens that became mature first at a high age had usually had a poorer growth rate not only from the start, but also in the continuation. The question has been left open whether this had been genetically determined or depended on environmental conditions like competition for food, etc.

A review has finally been devoted to the reports in literature about higher mortality in males compared with females and about the longevity of fishes in general in connection with maturity. Also here the results of the experiments have shown that often such reports are inconsistent with facts. Thus the earlier or later age for maturity and longevity, and in spite of the fact that the males practically always reach maturity one or two years before the females, mortality has not been perceptibly higher in the former than in the latter. Also at a high age, viz 9 years for perch and 10 years for trout, the sex ratio has been about 1 : 1.

The known circumstance that in the catches of older and larger specimens in nature the females are as a rule relatively commoner than the males depends with all certainty on the fact that the males are more active than the females. On this account a greater number of them is caught already at lower age, and they are also more exposed to the attacks of predators. (From auth. summ.)

3439. Anonymous. 1960. MANUAL OF FIELD METHODS IN FISHERIES BIOLOGY. Food and Agriculture Organization of the United Nations, FAO Manuals in Fisheries Science, No. 1, 152 pgs.

This is the first of several volumes which are intended to be handbooks of practical value to those engaged in fisheries research. Thus there will be volumes dealing, for example, with laboratory methods, sampling, gear selectivity and population dynamics.

This volume includes planning, recording, and reporting field work; research on fish stocks; field observations on fishing operations; observations on the physical and chemical environment; and observations on the biological environment.

3440. Leedy, Daniel L. 1959. PESTICIDE-WILDLIFE PROBLEMS AND RESEARCH NEEDS. Transactions of the Twenty-fourth North American Wildlife Conference, March 2, 3, and 4, 1959, New York City, pp. 150-165.

This paper points out the tremendous growth of chemical pesticide industry since 1940; reviews some of the findings from the relatively limited pesticide-wildlife research which has been conducted, especially as pertaining to effects of DDT on fish and wildlife; cites some of the more spectacular losses of fish and wildlife resulting from pesticide applications; lists some guidelines for use as fish and wildlife pro-

tective measures during spraying operations; describes some of the major problem areas and gives samples of endemic or other species of birds and mammals of special interest that may be endangered; briefly reviews current pesticide-wildlife research; and points out additional research needs. (From auth. concl.)

3441. Clark, Webster K. 1959. KODIAK BEAR-RED SALMON RELATIONSHIPS AT KARLUK LAKE, ALASKA. Transactions of the Twenty-fourth North American Wildlife Conference, March 2, 3, and 4, 1959, New York City, pp. 337-345.

Tagging experiments on a small stream with weir indicated that stream entry and redd establishment are almost simultaneous, and that female salmon may remain in such a stream nearly a week after spawned out. At this time they are fresh-looking but thin. Therefore some fresh-looking bear-taken remains could be spawnouts. Use of weirs on typical small tributaries to determine bear-take of "unspawned" (less than 50% spawned) salmon indicated little damage to present populations, although results varied from 31% (1947) to 1.5% (1955).

Salmon representing as much as 2.1% of the escapement may die naturally, unspawned. Bears often eat or mark carcasses.

By utilizing carcasses and so removing them from the stream, bears may help preserve runs by preventing fungus infestation, when other scavengers are not present. (From auth. summ. and concl.)

3442. Martin, N. V. 1960. HOMING BEHAVIOUR IN SPAWNING LAKE TROUT. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 3-6.

In spite of a marked homing behaviour lake trout will spawn on new artificial beds. The utilization of these areas may be expedited by various attraction methods.

3443. Budd, J. C., and F. E. J. Fry. FURTHER OBSERVATIONS ON THE SURVIVAL OF YEARLING LAKE TROUT PLANTED IN SOUTH BAY, LAKE HURON. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 7-13.

If the sea lamprey is controlled, there will be no difficulty in re-establishing a lake trout population in South Bay. Survival of planted yearlings to age IV is good, but the fish are completely eliminated by the sea lamprey before any of the females reach sexual maturity at age VII. To gain time, plantings should begin two or three years before complete control is in effect, and plantings of from 10,000 to 20,000 yearling of as large size as possible should be made for five or six years. At the end of this period, it could be expected that a population with a normal age distribution would be present. This population would then become self-sustaining. There is reason to believe that these same conclusions would be valid for Lake Huron proper, the North Channel and Georgian Bay. (From auth. concl.)

3444. Christie, W. J. 1960. VARIATION IN VERTEBRAL COUNT IN F_2 HYBRIDS OF SALVELINUS FONTINALIS X S. NAMAYCUSH. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 15-21.

The wide range of vertebral number in this sample and perhaps also the range in size, appear to be good evidence of normal pairing of chromosomes and subsequent segregation in the F_2 generation. Speckled trout and lake trout both have 84 chromosomes in somatic tissue and this presumably accounts for the viability which apparently reaches 75 per cent when lake trout eggs are fertilized with speckled trout milt. If the two parent chars had been genetically distinct for a period long enough for major changes in the chromosomes to have occurred, normal synapsis would have been impossible and the F_2 hybrids could only have been produced through polyploidy or from gametes carrying preponderance of chromosomes from one or the other of the parental species. Had meiosis in the F_1 generation been normal, one could have expected low fertility and offspring either distinctive with respect to heritable meristic characters or closely resembling one of the parent species. Since segregation took place for vertebral number, it is likely safe to assume that this would be true for all genetically determined characteristics. We can therefore tentatively conclude that the splake is a true hybrid, from recently evolved parent species, and selection for desirable characters to produce a new form is theoretically possible. It further seems evident that in lakes which provide satisfactory habitat for one or the other of the parent species, planted splake will only retain their identity for a few generations. (Auth.)

3445. Ryder, R. A. 1960. COMPARATIVE TAGGING RETURNS EMPLOYING THREE DIFFERENT ANAESTHETICS. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 23-25.

Tag returns from a total of 1,651 yellow pickerel tagged were greatest when M.S. 222 was employed as an anaesthetic. Much lower rates of return were experienced with fish anaesthetized in urethane or ether. The increased rate of tag return resulting when M.S. 222 was employed was possibly due to a lesser toxic or other deleterious effect, or to a more complete narcosis of the fish and thereby greatly facilitated the handling and increased the rate of tagging when fewer spasms were produced. (Auth. summ.)

3446. McDonald, J. G. 1960. A POSSIBLE SOURCE OF ERROR IN ASSESSING THE SURVIVAL OF PACIFIC SALMON EGGS BY REDD SAMPLING. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 27-30.

A considerable loss of dead eggs may occur during the incubation period in the gravel. The agencies responsible for this destruction include fungus, midge and cranefly larvae, and stonefly numphs. Although there was evidence to show that dead eggs were consumed, it could not be determined if living eggs were attacked.

The extent of the loss which occurred was related to the type of gravel in which the eggs were planted. This in turn apparently determined the abundance of

organisms which acted as agents of destruction. Large gravel was more suitable for the survival and development of the sockeye eggs, and also presumably more suitable for the existence of fungus and insect forms. Loss or destruction of eggs in the larger gravel was, therefore, greater than in the other types. Total non-recovery in all three types was estimated to be in the order of 22 per cent of the number planted. Although the conditions under which the eggs existed were artificial, there is reason to believe that in comparable conditions of restricted water flow and silting, such losses would occur naturally. Survival values determined from redd sampling may, therefore, be erroneously high, particularly in large gravel where disintegration of dead eggs most frequently occurs. (Auth. summ.)

3447. Baker, M. G., and H. H. Brohm. 1960. A MODIFIED ROLLER PRESS FOR SCALE IMPRESSIONS. The Canadian Fish Culturist, Issue Twenty-six, March, 1960, pp. 31-34.

The roller press, preferred by many workers, has one disadvantage. In order to obtain the correct pressure the space between rollers has to be set accurately. If the cellulose acetate slides and scales are uniformly thick, adjustments of the machine are infrequent and of minor concern. When slides vary in thickness adjustments are frequent and a relatively high percentage of the scales require re-rolling. This difficulty can be overcome by placing the upper roll of a jeweller's rolling press under air pressure held constant at any desired pressure up to 200 p. s. i. Uniformly good impressions are obtained despite differences in slide thickness and at a relatively high speed. (Auth.)

3448. Shanks, W. E., and J. E. Halver. 1960. RAPID ANALYSIS OF THE AMINO ACID CONTENT OF FISH DIETS. Progressive Fish Culturist, 22(2): 51-58.

Analysis of the 10 indispensable amino acids in 2 commercially available fish diets and a reference protein, casein, were conducted by 3 methods. Leucine, isoleucine, phenylalanine, valine, methionine, and threonine were separated on a single, unidimensional chromatogram employing n-propanol: PO_4 buffer, pH 7.3 (75:25). Lysine, histidine, and arginine were assayed using appropriate decarboxylating enzymes. Tryptophan was determined microbiologically. The values for casein were in good agreement with those reported in the literature. These methods can be applied readily for multiple amino acid analysis of protein sources. (Auth. abst.)

3449. Webster, Dwight A., and William Flick. 1960. RESULTS OF PLANTING KOKANEE SALMON IN TWO ADIRONDACK MOUNTAIN LAKES, NEW YORK. Progressive Fish-Culturist 22(2): 59-63.

Populations of kokanee (Oncorhynchus nerka) were established from fry plantings from Flathead Lake, Montana, stock. In one lake (25 acres) the first two year-classes planted were successful, a third was a failure. Divided age at maturity was observed in the first planting but was not evident in the second. Maturity was reached at 13.0 inches at age II+ and at 13.1 inches for individuals spawning 1 year later at III+. A minimum standing crop of 9 pounds of kokanee per acre was recovered when the lake was treated with rotenone 4 years after initial planting.

Only 1 year-class was planted in the second lake (44 acres). The matured at age III+ (no observations at II+) at a length of 17.3 inches, and spawning took place in the inlet stream. (D. A. W.)

3450. Wolf, Ken, C. E. Dunbar, and S. F. Snieszko. 1960. INFECTIOUS PANCREATIC NECROSIS OF TROUT. Progressive Fish-Culturist, 22(2): 64-68.

Infectious pancreatic necrosis of young trouts was studied in tissue culture. Explant-type cultures of tissues of several salmonids and of one centrarchid, and cultures of one transferable cell line of human origin, were used. Methods and findings are given. (Auth.)

3451. Horel, George, and Melvin T. Huish. 1960. THE EFFECTS OF FISH REMOVAL AND OTHER FACTORS UPON REMAINING FISH POPULATIONS AT LAKE TRAFFORD, FLORIDA. Progressive Fish-Culturist, 22(2): 73-76.

Lake Trafford, a shallow 1,400-acre lake in southwest Florida, was seined to reduce some fish species and to determine the effect of the reduction on other fishes. One hundred twenty-two drags made with a seine captured a calculated total of 230,753 pounds of fish. Of these, 46,577 pounds (comprised largely of crappie and bluegill) were released. The remainder (principally gizzard shad, gar, and bowfin) were destroyed. A comparison of average catch and number of hauls did not show that a progressive decline of pounds of removed species occurred. The average catch exhibited generally an inverse relationship to the water level and temperature. Removal of 132 pounds of fish per surface acre did not cause increased poundages of released fish during the study. (Auth. abst.)

3452. Rucker, R. R. 1960. OVARIAN FLUID: ITS ROLE IN FERTILIZATION. Progressive Fish-Culturist 22(2): 77-78.

A series of experiments using eggs and milt from cutthroat trout (Salmo clarki clarki) and silver salmon (Oncorhynchus kisutch) demonstrated that the sperm was activated by ovarian fluid prolonged the viability of the sperm, and that the eggs can be fertilized in ovarian fluid without the addition of water. (Auth. abst.)

3453. Lewis, William M. 1960. SUITABILITY OF WELL WATER WITH A HIGH IRON CONTENT FOR WARM-WATER FISH CULTURE. Progressive Fish-Culturist, 22(2):79-80.

Well water with a total iron content of 34 p. p. m. was studied to determine its suitability for warm-water fish culture. The water showed no toxicity to

golden shiners (Notemigonus crysoleucas), including fingerlings a few days old. It was concluded that water with a high iron content is suitable for filling and maintaining warm-water hatchery ponds. The water was not considered suitable for use in holding tanks because of the excessive amount of turbidity formed by the insoluble hydrated oxide. (Auth. abst.)

3454. Lux, Fred E. 1960. NOTES ON FIRST-YEAR GROWTH OF SEVERAL SPECIES OF MINNESOTA FISH. Progressive Fish-Culturist 22(2): 81-82.

First-season growth in a warm-water lake of spottail shiners (Notropis hudsonius), bluntnose minnows (Hyborhynchus notatus), Johnny darters (Boleosoma nigrum), banded killifish (Fundulus diaphanus), pike (Esox lucius), largemouth bass (Micropterus salmoides), bluegills (Lepomis macrochirus), pumpkinseeds (L. gibbosus), and yellow perch (Perca flavescens) was obtained by computing mean lengths of fish caught in seine hauls on 12 seining dates during the 1954 season. Second-season growth of yellow perch was obtained in the same manner. (Auth. abst.)

3455. Tarrant, Robert M., Jr. 1960. CHOICE BETWEEN TWO SIZES OF FORAGE FISH BY LARGEMOUTH BASS UNDER AQUARIUM CONDITIONS. Progressive Fish-Culturist 22(2): 83-84.

Largemouth bass (Micropterus salmoides) were held in tanks and offered green sunfish (Lepomis cyanellus) of two size classes. The numbers of sunfish eaten were noted daily and replaced with equal numbers of the same sizes. Even with only a small variation in size of largemouth bass, there was a positive correlation between size of forage fish eaten and size of bass. (Auth. abst.)

3456. Larsen, Charles M. 1960. TECHNIQUES FOR STUDYING HERRING SCALES AND OTOLITHS. Progressive Fish-Culturist 22(2): 85-86.

Techniques for mounting and photographing Atlantic herring (Clupea harengus) scales, and for clearing and photographing herring otoliths.

3457. Bailey, Jack E. 1960. COST IN RELATION TO SIZE OF MONTANA'S HATCHERY TROUT. Progressive Fish-Culturist 22(2): 69-72.

The total cost of rearing and planting hatchery trout in Montana's state-operated hatcheries was computed for the fiscal years 1955-56 and 1956-57. Costs ranged from $0.003 each for eggs and fry to $0.64 each for 10-inch fish. Roughly half of the total expenditures by these hatcheries was for certain nonproduction items. According to the cost-per-fish estimates, 63 percent of the total expenditures in 1957 was chargeable against only 4 percent of the fish that were planted as 7-inch or larger trout. Two factors are operating to induce increased production of increasingly larger trout: (1) the emphasis on cost per pound of fish produced as the single most significant figure in judging hatchery efficiency; (2) the fact that to produce at peak efficiency, hatcheries must operate at full capacity the year around. It is suggested that when evaluating hatchery plantings, more emphasis should be placed on the cost per creeled fish, with due consideration for size and quality of creeled fish. (Auth. abst.)

3458. Schwartz, Frank J. 1960. INEXPENSIVE SELF-CLEANING INVERSE AQUARIUM FILTER. Progressive Fish-Culturist 22(2): 87-89.

Construction plans and cost comparisons of a versatile, newly designed, easily cleaned aquarium filter that will meet the needs of many users are presented. The basic differences of the filter are a slanted (7°) floor and upward filtering. Suggested modifications and uses are also discussed. (Auth. abst.)

3459. Qadri, S. U. 1960. A SMALL DRAG NET FOR CAPTURE OF BOTTOM FISH AND INVERTEBRATES. Progressive Fish-Culturist 22(2):90-91.

A small drag net is designed to collect small bottom fish and invertebrates on sand flats and sand-mud flats in shallow or deep intertidal waters. Two persons can operate it from a boat; one person is sufficient if the net is not used from a boat or in deep water. The frame of the net is 3/4-inch solid brass rod. The 4-foot beam of the frame is screwed and bolted at the ends to two triangular runners and can be detached. The upper half of the cone-shaped bag (green plastic fly screen, 18 mesh to an inch) is 6.5 feet long; the lower half, with a stitched lead line, is 5.5 feet. The mouth of the bag has a spread of about 4 feet. Bags of different mesh sizes may be placed on the same frame, depending on the size of the fish desired.

3460. Marecek, Frank. 1960. THE THERMOS BOX FOR FISH-CULTURISTS WITH ICE PROBLEMS. Progressive Fish-Culturist 22(2): 92-93.

An insulated box that can be placed over a hole chopped in the ice to permit the feeding and observation of fish.

3461. Mais, Kenneth F., and Tom Jow. 1960. EXPLORATORY LONGLINE FISHING FOR TUNAS IN THE EASTERN TROPICAL PACIFIC, SEPTEMBER, 1955, TO MARCH, 1956. California Fish and Game, Vol. 46, No. 2, pp. 117-150.

The Marine Resources Operations of the California Department of Fish and Game conducted two exploratory tuna longline fishing and oceanographic cruises in the eastern tropical Pacific from September 1955 to March, 1956. On both cruises yellowfin tuna catch rates (0.28 per 100 hooks over all) were low compared to those made in other parts of the world. In certain areas the catches of bigeye tuna ranged from fair to good (1.0 to 2.0 per 100 hooks). A distinct latitudinal separation (2°N to 5°N) of the two species was found. Oceanographic data indicated environmental conditions were unfavorable for tunas at subsurface levels (oxygen less than 2.0 ml. per liter below 150 ft.) throughout much of the area investigated. (Auth. summ.)

3462. Wells, LaRue. 1960. SEASONAL ABUNDANCE AND VERTICAL MOVEMENTS OF PLANKTONIC CRUSTACEA IN LAKE MICHIGAN. Fishery Bulletin 172 from Fishery Bulletin of the Fish and Wildlife Service, Volume 60, pp. 343-369.

Plankton collections were made in Lake Michigan on seven occasions between June 6 and November 18, 1954, and 3 times between June 30 and October 2, 1955. The 1954 sampling area was about 8 miles off Grand Haven, Mich., at a depth of 74 meters, and the 1955 sampling was done about 3 miles offshore near Frankfort, Mich., at a depth of 46 meters. Limited sampling was also completed off Sturgeon Bay, Wis., on May 4, 1958. Collections were made with a Clarke-Bumpus plankton sampler with a net of No. 2 bolting silk. Series of samples were taken at about 2-hour intervals from 10-meter depth intervals from the surface to 40 meters (collections also from 5 meters in 1955).

Eight species of cladocerans and 9 species of copepods, as well as malacostracans, were collected in numbers sufficient to permit individual treatment. In addition, several cladocerans and copepods were taken in extremely small numbers. Eurycercus lamellatus, Polyphemus pediculus, Cyclops vernalis, and Senecella calanoides are reported for the first time from Lake Michigan.

Most species reached only one population peak a year. Apparently all cladocerans and the copepods Mesocyclops edax and Epischura lacustris overwinter as eggs in Lake Michigan.

All species migrated vertically to some degree. The vertical movements were influenced most strongly by diurnal changes in light intensity. Water temperatures also affected the migrations, especially of the cold-water forms. Migration toward the surface usually began late in the day. Most species attained their greatest numbers at the surface near sunset or soon afterwards. Numbers at the surface usually decreased toward midnight and, according to limited evidence, some species increased at the surface again between midnight and dawn. A few cold-water forms did not ordinarily migrate through a sharp metalimnion. (Auth. abst.)

3463. Van Oosten, John. 1960. TEMPERATURES OF LAKE MICHIGAN, 1930-32. United States Fish and Wildlife Service, Special Scientific Report--Fisheries No. 322, 34 pgs.

Lake Michigan temperatures were obtained at 136 stations, June 18-November 14, 1930, May 8-November 2, 1931, and April 19-September 12, 1932. One hundred and fifty series of vertical temperatures were obtained south of the Frankfort-Algoma line, 58 above this line in the lake proper, and 39 in Green Bay.

The text presents the data of relatively shallow and deep stations in nine regions covering the range of dates and depths, the seasonal changes of surface, the subsurface, and bottom temperatures, the shifting of 5-degree water, and the depth intervals and thermal gradients of thermoclines. General comparisons were made of the temperatures of the various regions. (Auth. abst.)

3464. Baggerman, Bertha. 1960. SALINITY PREFERENCE, THYROID ACTIVITY AND THE SEAWARD MIGRATION OF FOUR SPECIES OF PACIFIC SALMON (ONCORHYNCHUS). Journal of the Fisheries Research Board of Canada, Vol. 17, No. 3, pp. 295-322.

In juvenile Pacific salmon changes in salinity preference associated with seaward migration and thyroid activity were studied and used as criteria for the induction of the physiological condition required for migration (migration-disposition).

Four species of Oncorhynchus (chum, pink, coho and sockeye) changed preference from fresh to salt water at the onset of seaward migration and maintained this preference throughout the migration season. At the end of this migration period coho and sockeye salmon changed preference from salt to fresh water if retained in fresh water, indicating a re-adaptation to this medium in which they may survive for several years. Chum and pink fry did not show this change in preference and usually died when retained in fresh water. They were apparently unable to re-adapt to this environment.

The increasing day length in spring controls the time at which the change in preference from fresh to salt water takes place, and is thus involved in timing the induction of migration-disposition.

The photoperiod seems to affect particularly the pituitary-thyroid system. Thyroid activity increases shortly before the onset of migration, remains high during the migration season, and decreases towards its end. The level of thyroid hormone in the blood influences salinity tolerance and preference and, thus, the induction of migration-disposition. Metamorphosis, osmotic "stress" and iodine content of the water may have some additional effect on thyroid activity, but are not the only factors responsible for thyroid hyperactivity during migration.

Animals in which migration-disposition has been induced are thought to have become susceptible to appropriate external stimuli "releasing" migration. (Auth. abst.)

3465. MacLeod, Robert A., R. E. E. Jonas, and E. Onofrey. 1960. A BIOCHEMICAL STUDY OF COHO SALMON (ONCORHYNCHUS KISUTCH) MATURING SEXUALLY IN AN AQUARIUM. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 3, pp. 323-335.

Migrating coho salmon (Oncorhynchus kisutch) captured at a point near their entry into fresh water underwent sexual maturation when confined in an aquarium. Maturation was characterized by the development of secondary sex characters in the male and a considerable increase in the proportion of the body weight that could be accounted for as eggs in the female. Fish were sacrificed at intervals over the maturation period. Analyses of skeletal muscle, lateral line muscle, kidney, liver, heart, milt and roe for fat, protein and water, and skeletal muscle for sodium and potassium were made. Blood was analysed for total protein, non-protein, amino acids, glucose, sodium and potassium. With some exceptions, the changes observed exhibited the same general

trends as have been found in fish migrating under natural conditions. The extent of the changes, however, was considerably less.

Respiratory rates and glycolytic activities of the tissues analysed were also determined. No significant change in these measurements could be detected over the maturation period. (Auth. abst.)

3466. Wood, J. D., D. W. Duncan, and M. Jackson. 1960. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. XI. THE FREE HISTIDINE CONTENT OF THE TISSUES. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 3, pp. 347-351.

During the first 250 miles (400 km) of spawning migration of Fraser River sockeye salmon (Oncorhynchus nerka) the free histidine content of the muscle, alimentary tract, and head+skin+bones+tail decreased to a small fraction of the initial value. A further decrease occurred in the levels of this amino acid in the alimentary tract during the subsequent 415-mile (657-km) migration to the spawning grounds, no change being observed with the other tissues. Comparatively small changes in free histidine were found with heart, spleen, liver, kidney, and gonads during migration. (Auth. abst.)

3467. Trites, R. W. 1960. AN OCEANOGRAPHICAL AND BIOLOGICAL RECONNAISSANCE OF KENNEBECASIS BAY AND THE SAINT JOHN RIVER ESTUARY. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 3, pp. 377-408.

A preliminary survey of the oceanographic features of Kennebecasis Bay and the Saint John estuarial system was carried out in 1957-58 as part of the International Passamaquoddy Fisheries Board Program.

Kennebecasis Bay and Long Reach on the Saint John River are two-layer systems with a brackish surface layer overlying a deep saline layer. Two sills separate and restrict exchange of deep water in Kennebecasis Bay from that of the Bay of Fundy. The initial step in the formation of deep water of Kennebecasis Bay occurs in the gorge area between the two sills where saline water from the Bay of Fundy mixes vigorously with fresh water of the Saint John River. During periods of low river runoff combined with spring tides a portion of the mixed water penetrates inward over the sill at the entrance to Kennebecasis Bay.

It is concluded that Kennebecasis Bay represents more extreme conditions than those predicted for Passamaquoddy Bay if power dams are constructed. (Auth. abst.)

3468. Legare, J. E. Henri, and Delphine C. Maclellan. 1960. A QUALITATIVE AND QUANTITATIVE STUDY OF THE PLANKTON OF THE QUODDY REGION IN 1957 and 1958 WITH SPECIAL REFERENCE TO THE FOOD OF THE HERRING. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 3, pp. 409-448.

Investigations of the composition, abundance, and distribution of plankton communities within the Passamaquoddy region of New Brunswick and Maine were carried out in 1957 and 1958. Studies of the food of herring and possible relationships between zooplankton abundance, feeding activity, fat content, and catches of herring were included in the program. Similar quantities of zooplankton were found outside Passamaquoddy Bay and in Cobscook Bay. Slightly smaller volumes were taken in the passages into the Bay, but only one-fifth as much was taken in samples inside Passamaquoddy Bay. Differences in zooplankton abundance suggest incomplete mixing of outside waters with those of Passamaquoddy Bay. The smallest volumes of zooplankton were taken in the spring and the largest in the summer months. Overall zooplankton volumes were much higher in 1958 than in 1957.

There was evidence that herring were feeding in the upper water layers. A period of low feeding activity from March to August was followed by a period of active feeding from September to November. There was a positive correlation between feeding activity and fat content of herring but no relationship between quantities of zooplankton and feeding activity could be established. Nor was it possible to demonstrate any relationship between zooplankton volumes and catches of herring over a period of 10 years.

Higher zooplankton volumes are foreseen for Passamaquoddy Bay after the dams are built. Volumes in Cobscook Bay are expected to reach values similar to those of Passamaquoddy Bay while those outside should remain unchanged. (Auth. abst.)

3469. Brown, Edward H., Jr. 1960. LITTLE MIAMI RIVER HEADWATER-STREAM INVESTIGATIONS. Ohio Department of Natural Resources, Final Report Dingell-Johnson Project F-1-R, 143 pgs.

Streamflow and suspended-sediment discharge in the Little Miami River headwater area exhibited great extremes during the period 1952 to 1957. Severe drouth conditions occurred in the summers and falls of 1953 and 1954, followed by a rising trend in precipitation and streamflow in 1955, 1956 and 1957. Annual water and suspended-sediment discharges increased severalfold between 1954, the peak drouth year, and 1956, the year of greatest discharge. Duration of streamflow during dry weather in the Little Miami River headwater area was related to the character and distribution of glacial deposits which cover the underlying bedrock. Certain meteorological elements that affected stream conditions had important bearing upon the production of the smallmouth black bass, Micropterus dolomieui, and possibly upon the production of other species. Annual fluctuations in length of the smallmouth black bass in Massie Creek and the Little Miami River and of the rock bass, Ambloplites rupestris, in Massie Creek for the period 1950-1956 correlated positively with mean monthly air temperatures of April through October and of several other individual months and combinations of months. A correlation between streamflow and growth of game fish was not apparent. Fishing success for all sizes of smallmouth black bass in Massie Creek by cooperating

anglers was high in 1954 at 1.1 fish per hour, declined in 1955 to 0.6 fish per hour, and then increased again in 1957 and 1958 to 1.2 fish per hour. Under the land-use segment of the Investigations, an estimated 15 per cent of the total farm acreage of the project area was placed in improved farm plans, bringing the total planned acreage to about 38 per cent. No correlation was observed between this small percentage of land placed in conservation plans and stream conditions or conditions of the fisheries.

3470. Martin, W. R. 1960. PREDICTED EFFECTS OF PROPOSED TIDAL POWER STRUCTURES ON GROUNDFISH CATCHES IN CHARLOTTE COUNTY, N. B. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 169-173.

It is predicted that the construction of power structures will have no measurable effect on Charlotte County groundfish landings as a whole. It is expected that the 1,700,000 lb or 12% of the Charlotte County groundfish catch, taken in 1958 inside the dam sites, will be greatly reduced. Specifically, it is forecast that the pollock line fishery in Head Harbour Passage, which yielded 1,500,000 lb in 1958, will be greatly reduced, the haddock dragger fishery will be reduced or eliminated in the high pool, and the flounder fishery in Passamaquoddy and Cobscook Bays will probably increase. (Auth. abst.)

3471. McCracken, F. D. 1960. STUDIES OF HADDOCK IN THE PASSAMAQUODDY BAY REGION. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 175-180.

From 1954 to 1957 haddock within Passamaquoddy Bay have been of intermediate sizes. Few small fish or large fish have been captured either by commercial fishermen or in small-mesh research nets. Tagged fish of the Passamaquoddy Bay region moved out of the Bay during winter and mingled mainly with haddock stocks off the New England States. In the following summer recaptures of tagged fish were again most numerous within Passamaquoddy Bay. Stocks of haddock within the Bay appear to result from annual migrations into the Bay in early summer. It is predicted that the proposed power structures would have no effect on haddock stocks outside the high and low pools but that they would probably seriously reduce the haddock population within the high pool. (Auth. abst.)

3472. Bumpus, Dean F. 1960. SOURCES OF WATER CONTRIBUTED TO THE BAY OF FUNDY BY SURFACE CIRCULATION. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 181-197.

The returns from the 35,000 drift bottles launched in the Gulf of Maine area since 1919 have been analyzed to determine the annual cycle of surface drift. The source of surface flow into the Bay of Fundy expands from a minimum during January in the offing of the eastern side of the bay to a maximum in May which includes most of Georges Bank, the Gulf of Maine and the southwestern Scotian Shelf, then commencing in September gradually contracts toward the minimum.

Secular variations in the removal of surface water from the Bay of Fundy, indicative of changes in the Maine eddy, were noted during 1957 and 1958. (Auth. abst.)

3473. Parker, Robert R. 1960. CRITICAL SIZE AND MAXIMUM YIELD FOR CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA). Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 199-210.

Instantaneous natural mortality rate is estimated from tagging and recovery data and compared with instantaneous relative growth rates for each life history type of chinook salmon. It is demonstrated that critical size is not attained prior to maturity, hence, juveniles should be protected from fishing if maximum yield in pounds is desired. Yield cannot be increased by a minimum size regulation, for losses due both to direct injury and hyperactivity reduce critical size to levels not ordinarily encountered by existing fisheries. A further complication arises in that size is not a reliable indicator of maturity. The most feasible alternative to a minimum size regulation appears to be spatial and temporal restriction of the fishery to known concentrations of maturing fish, together with the encouragement of non-size-selective gear. (Auth. abst.)

3474. Steinar, Olsen. 1960. OBSERVATIONS ON SOUND SCATTERERS IN NEWFOUNDLAND WATERS. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 211-219.

A sound scattering layer in the warm surface water or at the depth of the summer thermocline has frequently been observed off the southern and western coasts of Newfoundland. The scatterers have not been identified, but are most likely of biological nature.

An observation of a diurnal vertical migration of a deeper scattering layer is reported. (Auth. abst.)

3475. Neave, Ferris, and M. G. Hanavan. 1960. SEASONAL DISTRIBUTION OF SOME EPIPELAGIC FISHES IN THE GULF OF ALASKA REGION. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 221-233.

Distribution of various species of fishes in the Gulf of Alaska region in early, middle and late summer of 1956 and 1957, as determined by fishing with surface gillnets, is plotted.

The surface area occupied by steelhead and by four species of Pacific salmon is considerably reduced during the same period. There is no obvious seasonal change in the distribution of the salmon shark.

Seasonal changes in range of occurrence conform with temperature changes in the surface waters and are more extensive in the eastern part of the Gulf. (Auth. abst.)

3476. Lambert, D. G. 1960. THE FOOD OF THE REDFISH SEBASTES MARINUS (L.) IN THE NEW-

FOUNDLAND AREA. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 235-243.

Samples of redfish stomachs were collected from the Newfoundland area and were analysed both qualitatively and quantitatively. In the sampled area the most important items of the diet of these fish are amphipods, fish and euphausians. There is a change in the diet of the redfish related to size. The redfish feeds on pelagic organisms and not on benthic forms. (Auth. abst.)

3477. Battle, Helen I., and William M. Sprules, 1960. A DESCRIPTION OF THE SEMI-BUOYANT EGGS AND EARLY DEVELOPMENTAL STAGES OF THE GOLDEYE, HIODON ALOSOIDES (RAFINESQUE). Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 245-265.

The goldeye in Canada occurs in large muddy rivers and associated lakes, being most abundant on the plains. Spawning usually occurs from late May to early July. In Lake Claire, Alberta, males reproduce first at 6-9 years of age and females at 7-10 years; in southern Manitoba first maturity averages 2 or 3 years earlier than this. Goldeye eggs were discovered in Lake Claire. They are bathypelagic or semi-buoyant, a characteristic which is rare among freshwater fishes. The egg is spherical, measures 4 mm in diameter, has a wide perivitelline space, coarsely granular yolk, and a large oil droplet. Prehatching developmental stages, including the multicellular blastoderm, the 41- and the 51-somite embryos, are described; as are the diagnostic characteristics of early larvae (7.27-7.63 mm), late larvae (11.8-15.6 mm), postlarval young fish (16.0-29 mm). and a 33 mm fish. (Auth. abst.)

3478. Vladykov, Vadim D. 1960. DESCRIPTION OF YOUNG AMMOCOETES BELONGING TO TWO SPECIES OF LAMPREYS: PETROMYZON MARINUS AND ENTOSPHENUS LAMOTTENII. Journal of the Fisheries Research Board of Canada, Vol. 17, No. 2, pp. 267-290.

The description of young ammocoetes, 19-68 mm in length, belong to Petromyzon marinus and Entosphenus lamottenii, is given. The principal differences between species consist in the intensity and pattern of the pigmentation. For identification, in decreasing order of importance, the different sections of an ammocoete are as follows: the dorsal surface of the head and trunk, the lateral side of the head, and the tail region. Among the other characters are described the peritoneum, which is pale, unpigmented in E. lamottenii and darkly pigmented in P. marinus; and the precursor of the tongue, the dark pigmentation of which is found in 98% of E. lamottenii and only in 11% of P. marinus. (Auth. abst.)

3479. Anonymous. 1960. PROGRESS IN SPORT FISHERY RESEARCH, 1959. U. S. Fish and Wildlife Service Circular 81, 80 pgs.

This report includes summaries of sport fishery research investigations during 1959 by the several U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife laboratories and stations.

3480. Beaven, G. Francis. 1960. TEMPERATURE AND SALINITY OF SURFACE WATER AT SOLOMONS, MARYLAND. Chesapeake Science, Vol. 1, No. 1, pp. 2-11.

Daily temperature and salinity values of surface water at Solomons, Maryland, midway down the Chesapeake estuary, have been tabulated and averaged for a 20-year period. Fluctuations are shown by graphic representation of the monthly means and ranges. Relationship of the Solomons data to those for other parts of the Chesapeake is discussed.

Water temperatures have varied from 30° to -0.8°C and do not deviate widely from the average annual pattern. Seasonal 20-year means are: winter 4.3°, spring 11.9°, summer 25.6° and fall 18.2°. The freezing point was reached during 4 years of the 20-year base period.

The seasonal salinity pattern is rather variable with minima usually reached in late spring and maxima in late fall. Long-term trends show a much greater range than do fluctuations associated with stage of tide, local precipitation and wind-generated water movements. Extreme values are 20.4 and 5.4 parts per thousand. Seasonal 20-year means are: winter 14.8, spring 11.4, summer 12.3 and fall 15.7. (Auth. abst.)

3481. Mansueti, Romeo. 1960. COMPARISON OF THE MOVEMENTS OF STOCKED AND RESIDENT YELLOW PERCH, PERCA FLAVESCENS, IN TRIBUTARIES OF CHESAPEAKE BAY, MARYLAND. Chesapeake Science, Vol. 1, No. 1, pp. 21-35.

Yellow perch, Perca flavescens, procured from the Chester River estuary, were tagged and stocked on a "put and take" basis in the upper parts of the Severn and Magothy Rivers in tidewater Maryland. Subsequent movements were spectacularly different from those of resident fish. Stocked fish (of which about 20 percent were recaptured) attempted immediately to leave the rivers. Their essentially random movements distributed them widely, from the Susquehanna Flats to Tilghman Island in Chesapeake Bay, over a salinity range from tidal freshwater to about 12 ppt. Recaptures of about 10 percent of tagged resident fish indicate that few of them leave the Severn River.

A small, unknown number of stocked fish remained within the Severn and Magothy Rivers for over two years and were presumably acclimatized. Tag recaptures were also returned from Chesapeake Bay localities for a two year period following the February 1956 stocking. Most (75 percent) of the tagged fish were recovered outside the two tributaries during the first four months; many were taken during the first month of freedom. Very few stocked returned to the Chester River. It is suggested that those trying to return failed because they were removed too far to rely on their visual, tactile and olfactory faculties to guide them successfully. A discussion of the

other factors that might bring about the striking dispersal is also given. It is concluded that "put and take" stocking of adult estuarine yellow perch in strange waters is of doubtful management value in Chesapeake Bay. (Auth. abst.)

3482. Elser, Harold J. 1960. CREEL CENSUS RESULTS ON THE NORTHEAST RIVER, MARYLAND, 1958. Chesapeake Science, Vol. 1, No. 1, pp. 41-47.

Fishing pressure in the Northeast River, a freshwater tidal tributary of Chesapeake Bay, was very light in 1958. Only 2.4 trips per acre were estimated for the five month period, June through October. Data, collected by one field man who interviewed and counted anglers daily, indicated that the rate of harvest was 0.29 fish per man hour, and that the average catch (keepworthy fish only) amounted to 1.5 fish per fishing trip. Channel catfish, largemouth bass, white perch and yellow perch, in that order, were the most important species in the creel. (Auth. abst.)

3483. Pritchard, D. W. 1960. SALT BALANCE AND EXCHANGE RATE FOR CHINCOTEAGUE BAY. Chesapeake Science, Vol. 1, No. 1, pp. 48-57.

Chincoteague Bay is a bar-built estuary with two inlets from the Atlantic Ocean - one at Ocean City, Maryland, and the other some 30 miles southward at Chincoteague Inlet. All available salinity data collected in the years 1951 through 1956 are utilized here to evaluate the processes which control the average monthly salinity in the bay. The major features of the salt balance are satisfactorily explained by a simple model equating the rate of change of salinity to terms involving net fresh water inflow and exchange rate through the inlets. An estimation of the exchange rate is made which indicates that approximately seven percent of the volume of the bay waters are renewed each day. (Auth. abst.)

3484. Arve, John. 1960. PRELIMINARY REPORT ON ATTRACTING FISH BY OYSTER-SHELL PLANTINGS IN CHINCOTEAGUE BAY, MARYLAND. Chesapeake Science, Vol. 1, No. 1, pp. 58-65.

Oyster-shell plantings were made on formerly productive bottom to determine the practicability of securing an oyster set in this area and to test the hypothesis that the availability of game fish could be improved by artificially modifying the habitat in Chincoteague Bay, Maryland. Fish populations were trapped over planted and unplanted control areas with the same effort from August to November in 1958 and 1959. Fourteen species of saltwater fish were recorded in the planted and control areas, of which the black sea bass, Centropristes striatus, was the dominant species.

The planted areas yielded about three times as many fish as the controls during the two years. Black sea bass numbers were much greater on planted areas than on control areas. The planted area also produced more species than the unplanted area. More fish were caught over both planted and control bottoms during 1959 than in 1958, due partially to improved trap design. There is some evidence of improvement in the availability of fish over a planted area that has aged for a year. It is concluded that oyster-shell plantings significantly concentrated and increased numbers of fish over restricted areas, when compared to unplanted areas. (Auth. abst.)

3485. Murphy, George J. 1960. AVAILABILITY OF STRIPED BASS DURING SUMMERS OF 1958 AND 1959 AS REFLECTED IN COMMERCIAL HAUL SEINE CATCH. Chesapeake Science, Vol. 1, No. 1, pp. 74-75.

An analysis of the Maryland summer haul seine fishing effort and landings of striped bass, Roccus saxatilis, for the years 1958 and 1959 shows a doubling in harvest with a reduction of one-sixth in seine days fished during 1959. It is concluded that striped bass were available in considerably greater numbers to this gear in 1959 than in 1958, and that the 1956 and 1957 year-classes probably contributed largely to these landings. (Auth. abst.)

3486. King, Willis. 1960. A SURVEY OF FISHING, IN 1959, IN 1,000 PONDS STOCKED BY THE BUREAU OF SPORT FISHERIES AND WILDLIFE. U. S. Fish and Wildlife Circular 86, 20 pgs.

Pond owners reported that their principal reasons for building the ponds were to provide water for livestock (80 percent) and fishing (70 percent). Of those persons fishing the ponds, 52 percent were men, 23 percent women, and 25 percent children. Eighty-two percent of the ponds were described as providing excellent or satisfactory fishing. Ponds provided fishing in 1959 at the rate of 64 fisherman-days per acre. Bass and bluegill were the principal species, with an average catch of 54 bass and 276 bluegill and other sunfish per acre. Catfish, including bullheads, contributed to the fishing in 20 percent of the ponds.

Twenty-one percent of the pond owners had added fish on their own, and 30 percent of the ponds contained wild fish. In ponds where fishing was unsatisfactory, too many small bluegills, muddy water, and presence of wild fish were the reasons most commonly advanced.

Assuming a productive life of at least 5 years, and projecting the findings on 1,000 ponds to all ponds stocked by the Bureau, from 1953 to 1957, it is estimated that more than 20 million man-days of fishing were provided to at least 5 million persons in 1959, as a result of this program.

These anglers are estimated to be 25 percent of all persons fishing in fresh water that year, and to have exerted 5 percent of the fishing effort. The cost to the Government for the fish stocked in the ponds was under 5 cents for each man-day of fishing provided. It must be concluded that providing fish from our national fish hatcheries to stock farm and ranch ponds is making a substantial contribution to the recreation of a large segment of our people, and

at a relatively low cost. (From auth. summ.)

3487. Ridgway, George J., and George W. Klontz. 1960. BLOOD TYPES IN PACIFIC SALMON. U.S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 324, 9 pgs.

Intraspecific differences in erythrocyte antigens (blood types) were shown to occur in four species of Pacific salmon, the sockeye or red salmon (Oncorhynchus nerka), the chinook or king salmon (O. tshawytscha), the chum salmon (O. keta), and the pink salmon (O. gorbuscha). Antisalmon-erythrocyte sera prepared in rabbits and chickens were used after absorption of species-specific antibodies. Some of these blood types were shown to differ in their frequency of occurrence between different geographic races. In addition, isoimmunizations were conducted on one race of sockeye salmon. Antisera of seven different specificities were prepared and at least eight different patterns of antigenic composition were displayed by the cells tested.

These results indicate that considerable antigenic diversity exists in salmon. Reagents to detect valuable markers for the investigation of geographic races of salmon should be obtained through further research. (Auth. abst.)

3488. Ross, A. J., and R. R. Rucker. 1960. A "VIRUS" DISEASE OF CHINOOK SALMON. U. S. Fish and Wildlife Service Fishery Leaflet 497, 3 pgs.

This leaflet covers identification, cause of disease, source and reservoir of infection, mode of transmission, incubation period, period of communicability, susceptibility and resistance, range, occurrence and method of control.

3489. Miller, Robert Rush. 1960. SYSTEMATICS AND BIOLOGY OF THE GIZZARD SHAD (DOROSOMA CEPEDIANUM) AND RELATED FISHES. Fishery Bulletin 173 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 371-392.

The gizzard shads, marine and fresh-water herrings of the subfamily Dorosomatinae, are characterized and keys are given to the seven known genera and to the five species of the American genus Dorosoma (Signalosa is regarded as a subgenus). The systematics and biology of the eastern gizzard shad, Dorosoma cepedianum, are treated in detail. The biological information results largely from a critical survey of papers (unpublished as well as published) dealing with its fecundity, reproduction and development, size, age and growth, abundance, habitat and migration, mortality, parasites and predators, and its food, forage value, and utilization by man. Original drawings of early life-history stages are presented. This summary should enable fishery biologists concerned with inland waters to gain a more comprehensive outlook on the role of the gizzard shad in fish management. (Auth. abst.)

3490. June, Fred C., and Charles M. Roithmayr. 1960. DETERMINING AGE OF ATLANTIC MENHADEN FROM THEIR SCALES. Fishery Bulletin 171 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 60, pp. 323-342.

Scales of Atlantic menhaden, Brevoortia tyrannus, are described and results of detailed examination summarized for the purpose of determining whether certain recognizable rings are reliable age marks. Based on the occurrence of one or more dominant modes in monthly frequency distributions of scale measurements of two separate ring classes, it was shown that (1) the modes representing each ring remained homologous, (2) an increase in the number of rings was accompanied by an increase in the length of the scales, (3) the distance between modes representing the last submarginal ring and the edge of the scale decreased with the addition of each new ring, (4) new scale growth was greatest during the warm months of the year, reaching a maximum in the fall, and (5) scale rings are formed only once each year and thus are reliable age marks. Differences were observed in the growth of scales from fish assigned to two different ring classes, and new scale growth was found to be greatest in southern coastal waters and in younger fish. Examination of scales from fish confined over a 14-month period showed that only one ring had formed, thus verifying the validity of the scale method. (Auth. abst.)

3491. Gunning, Gerald E. 1959. THE SENSORY BASIS FOR HOMING IN THE LONGEAR SUNFISH, LEPOMIS MEGALOTIS MEGALOTIS (RAFINESQUE). Invest. Indiana Lakes and Streams 5: 103-130; Biological Abstracts, Vol. 35, No. 7, Abst. No. 17954. 1960.

The ability of the longear sunfish to return to a home range from an unfamiliar area 200 to 350 feet away was studied in Richland Creek, Indiana. It was assumed that homing has a sensory basis. Attention was focused on the olfactory and visual senses, since these senses are known to be involved in homing in other species of fishes. Experiments were conducted with four major categories of fish: (1) blinded fish, (2) fish with olfaction impaired, (3) fish with both vision and olfaction impaired, and (4) controls. The homing abilities of the three categories of treated fish were compared with the homing ability of controls. Blinded individuals homed as quickly and accurately as controls. Fish whose olfactory mechanism was impaired moved at random. They could not return to the home range with the precision shown by controls. Those individuals with both senses impaired were entirely disoriented. Indirect evidence was derived from a study of the relative homing abilities of control longear sunfish moving upstream toward home versus those moving downstream toward home. The precision of those fish homing in the upstream direction was found to be greater than that of those moving downstream. This is to be expected since odors from the home range would be carried to fish homing in the upstream direction by the current. The main conclusion was that the olfactory mechanism of the longear sunfish mediates homing. The fish search for their home range and apparently recognize the area by a characteristic odor, or possibly a combination of odors. (Auth. abst.)

3492. Fraga, F. 1959. DETERMINATION OF ORGANIC NITROGEN SUSPENDED AND DISSOLVED IN SEA WATER. (DETERMINACION DE NITROGENO ORGANICO SUSPENDIDO Y DISUELTO EN EL AGUA DE MAR.) (English summary) Invest. Pesq. 14: 121-127; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18005. 1960.

An improvement of the Kjeldahl method has been developed to eliminate interferences by ammonia, nitrites and nitrates. Samples of 100 ml water are used and the mean deviation of results is $\pm$ 0.7 mg N/l. The new procedure modifies the 1st part of the customary Kjeldahl method. The sample is poured into a 200 ml flask, with 1 ml of N/2 NaOH. Volume is reduced to half after boiling about 20 minutes. After partial cooling, 2 glass beads are introduced and 10 ml of a reagent is made by dissolving 5.6 g $FeSO_4 . 7H_2O$ in 620 ml of redistilled water and adding 450 ml of H_2SO_4 of density 1.84. The mixture is boiled very carefully, avoiding splashing; when white vapors appear, the flame is lowered and the ebullition is maintained further 40 minutes. After cooling, the liquid is diluted and the operation follows in the ordinary way. (R. M.)

3493. Krau, Luiza. 1958. MODIFICATIONS IN THE PLANKTON OF ENSEADA DE INHAUMA, BEFORE AND AFTER POLLUTION. (MODIFICACOES NO PLANCTON DA ENSEADA DE INHAUMA, ANTES E DEPOIS DA POLUICAO. Mem. Inst. Oswaldo Cruz 56(2):473-476; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18010.

A list of species taken in 1918, when the water was pure, is given. Examination made in the same locality, in 1944, by the hydrobiological station of the Ilha do Pinheiro, showed great changes. The truly marine species no longer occurred at Enseada. There was a predominance of larvae of crustaceans and molluskan larvae. In 1958 the water is as black as carbon, with protozoa, Myxophyceae, and Oscillatoriaceae, characteristic indicators of extremely polluted water.

3494. Park, Kilho, Donald W. Hood, and Howard T. Odum. 1958. DIURNAL pH VARIATION IN TEXAS BAYS, AND ITS APPLICATION TO PRIMARY PRODUCTION ESTIMATION. Publ. Inst. Marine Sci. Publ. 5: 47-64; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18016. 1960.

The net total CO_2 change observed by the in situ diurnal pH change data of 0.07-0.68 pH units at selected Texas bays of chlorinity ranging between 15.7-36.1% was calculated to be 0.12-0.92 mM/l/day. Primary production estimation by this method was slightly higher than the diurnal O_2 method; 0.12-0.92 and 0.13-0.88 mM/l/day or inorganic C for pH and O_2 methods respectively. Productivity in summer was 1.5 to 2 times greater than in winter. (Auth. abst.)

3495. Czeczuga, Bazyli. 1957. THE EFFECT OF HUMUS COMPOUNDS ON ZOOPLANKTON. (WPŁYW ZWIAZKOW HUMOSOWYCH NA ZOOPLANKTON.) (In Polish with Russian and English summ.) Rocz. Akad. Med. Juliana Marchlewskiego Białymstok 3: 85-126; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18023. 1960.

Lakes Blado, Bladko and Mlynek, belonging to the Narocz groups of lakes (U.S.S.R.) and also temporary collections of water (pools), in the Narocz district were examined. In order to compare evidence obtained from natural sources, laboratory observations also were carried out in the years 1953-1955. It was found that Lake Mlynek contains a great deal of fulvic acids (630°), Lake Bladko, an average amount (120°), and Lake Blado, little, as compared to the former lakes (45°). Laboratory experiments showed that water containing humus compounds is toxic for Daphnia pulex, Leptodora kindti and Simocephalus serrulatus. The survival of Cladocera in experiments with water containing humus compounds depends on the concentration of these compounds, the temperature and pH. Diaptomus gracilloides, D. amblyodon did not react unfavorably to the humus compounds contained in the water taken for the experiments. (Auth. summ.)

3496. Daily, William A. 1959. IN SEARCH OF SOME BLUE-GREEN WANDERERS. Proc. Indiana Acad. Sci. 68:43-57; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18024. 1960.

A presidential address. The species composition of the planktonic myxophycean communities of some lakes and ponds of Indiana has been discussed. It is concluded that in lakes of glacial origin in Indiana, at this time, there exists a definite combination of species. The artificial or man-made reservoirs also support a fairly definite and different community of blue-green plankters. The list of all known myxophycean plankters and their distribution in Indiana lakes and ponds is based upon herbarium specimens. The distribution figures appearing on the United States map were noted also from herbarium specimens. (Auth. summ.)

3497. Eberly, William R. 1959. THE METALIMNETIC OXYGEN MAXIMUM IN MYERS LAKE. Invest. Indiana Lakes and Streams 5: 1-46; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18025. 1960.

In 1951 (and for 4 successive summers thereafter) Myers Lake in Marshall County in northern Indiana developed a pronounced and very persistent O_2 maximum at about 8 m, well down in the metalimnion. O_2 concentration at this level ranged as high as 23.3 ppm, with mean summer values of 18.35, 19.98, 13.98, and 15.71 ppm for the summers of 1952-1955, respectively. The O_2 maximum is correlated chiefly with a dense population of Oscillatoria agardhii, which is the dominant phytoplankter the year round in Myers Lake. Myers Lake can be characterized as a "bluegreen-diatom" lake. The small daily net production of O_2 in the metalimnion can accumulate to form the large maxima observed in the lake only if the metalimnion is protected from turbulent disturbances. The extent of eddy diffusion can be estimated from temperature changes that occur in the clinolimnion. Mean values of the clinolimnetic coefficient of eddy conductivity varied from 0.09 to 0.50, being inversely correlated with the mean summer O_2 maxima. Overall stability of a lake is af-

fected by the shape of the lake basin, climatic conditions early in the spring, degree of protection afforded by the lake's surroundings, etc. Myers Lake has very steep sides (volume development = 1.17 for the West Basin). Because it is surrounded by a high bank covered by a dense growth of trees, the thermocline forms early in the season at a relatively shallow level (above 3 m). As stratification proceeds, the intensity of the thermal gradient increases, making it more difficult for wind-induced turbulence to penetrate the metalimnion. Mean stability of Myers Lake ranged from 466 to 507 g/cm^2, with a positive correlation between stability and mean summer O_2 maxima. Myers Lake is compared with some other lakes showing similar O_2 maxima, and a brief contribution toward a generalized theory of the metalimnetic O_2 maximum is presented. (Auth. abst.)

3498. Havinga, B. 1958. THE FAUNA AT THE TRANSITION FROM ZUYDERSEA TO YSSELLAKE. (DE FAUNA BIJ DE OVERGANG VAN ZUIDERZEE TOT IJSSELMEER.) Natura 55: 89-91; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18028. 1960.

The formerly poly- to mesohaline Zuydersea was closed by a dike in 1932, and transformed gradually into a nearly fresh lake. The changes in the water fauna are briefly described. (J.H.S.)

3499. Provost, Maurice W., and Nina Branch. 1959. FOOD OF CHIRONOMID LARVAE IN POLK COUNTY LAKES. Florida Ent. 42(2):50-62; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18039. 1960.

Glyptotendipes paripes larvae may occur in large numbers in lakes of central Florida. They prefer sand bottoms and are deterred by accumulations of organic matter. Enriching the lakes with nutrients, e.g. effluents of sewage-treatment plants, increases lake plankton and thus chironomid production. Correlations are given between numbers and volumes of various plankton groups in 13 selected lakes and the guts of 284 G. paripes and 108 Tendipes decorus. A positive correlation is shown between density of plankton in lakes and in chironomid stomachs. (Authors)

3500. Spodniewska, Irena. 1958. THE PHYTOPLANKTON OF RIVERSIDE ENVIRONMENTS. (FITOPLANKTON SRODOWISK PRZYRZECZNYCH.) (English summary) Ekol. Polska 6(3): 131-143; Biological Abstracts, Vol. 35, No. 7, Abst. No. 18040. 1960.

The aim of this work was to investigate the degree of abundance of the phytoplankton in various types of riverside environments, and to grasp the possible dependence of the development of the plankton on changes in the environment connected with rises in the water level. The site of the research work was the Konfederatka Pool adjoining the Vistula near Wyszogrod, and various chosen positions on the Vistula, i.e. positions on the mainstream of the river, on sandbanks in the middle of the river, and other riverside positions more or less affected by the current. Investigations were carried out from the middle of April to the end of September 1955. Test samples were taken approximately every 10 days. Three maximums of the phytoplankton were observed on the majority of the positions during the whole period of the research work. A considerable amount of plankton was present in all the environments. Figures illustrating the extent of these maximums vary within the limits of 30-150 thousand organisms/l of water. The dominating group throughout the investigations were Diatomeae, with Chlorophyceae coming 2d. Flood periods were distinguished by a decrease in the amount of phytoplankton. (Auth. summ.)

3501. Walker, Charles R. 1959. CONTROL OF AQUATIC WEEDS IN MISSOURI FARM PONDS. Weeds 7(3):310-316; Biological Abstracts, Vol. 35, No. 7, Abst. No. 19646. 1960.

The use of 16-20-0 water soluble ammonium phosphate fertilizer holds promise of increasing fish production and of controlling certain submersed aquatic weeds. Plants which this fertilizer has controlled include pondweeds (Potamogeton), and certain filamentous algae. Pelleted simazin also was effective in controlling most submerged weeds. (J. vO.)

3502. Collignon, Jean. 1959. THE SYSTEMATICS OF THE SCIAENIDAE OF THE EASTERN ATLANTIC. (LA SYSTEMATIQUE DES SCIAENIDES DE L'ATLANTIC.) (English summ.) Bull. Inst. Oceanogr. 1155. 1-11; Biological Abstracts, Vol. 35, No. 7, Abst. No. 19964. 1960.

On the eastern coast of the Atlantic, the family includes 17 well characterized spp. but known under different names according to the various authors. Taking into account the generic distinctions used in the other parts of the world, and after study of anterior works, we can distinguish 3 large groups in the sciaenids studied: (1) The genera Otolithus Cuvier, Atractoscion Gill and Pseudosciaena Bleeker. These are sciaenids with more or less caninoid differentiated teeth. (2) The genus Larimus Cuvier: Sciaenids without caninoid teeth, with a great and oblique mouth and long branchictenies. (3) The genera Johnius Bloch and Sciaena Linne; sciaenids with a small, horizontal or inferior mouth without caninoid teeth. In each group the nomenclature of the spp. is determined according to the genera where they are classified and the law of priority. The distinction among 3 groups and the position of the generic limits allows us moreover to express an hypothesis touching the evolution within the family in the observed region. (Auth. summ.)

3503. Herre, Albert W. C. T. 1958. MARINE FISHES IN PHILIPPINE RIVERS AND LAKES. Philippine Jour. Sci. 87(1): 65-88; Biological Abstracts, Vol. 35, No. 7, Abst. No. 19968. 1960.

Five lists are given, with 234 spp. of marine fishes returning to the sea or to brackish water to spawn, 34 spp. of marine fishes known to occur in fresh water but with no exact and definite Philippine record of such occurrence, 36 spp. of fishes of marine origin now living and breeding in fresh water

(as far as is known) and not going to brackish or salt water, 2 spp. of fishes of marine origin now living and breeding in fresh water but known to enter brackish and salt water at times, and 1 sp. of freshwater fish which enters salt water and apparently breeds freely in fresh, brackish, and salt water. The combined list contains 607 spp., a number more than twice that known from the entire American continent north of Panama. The order Gobioidea has the largest number (75 spp.) of euryhaline fishes in the Philippine fauna. Behavior is discussed for some of these spp. Other marine groups which are strongly represented in rivers and lakes are the mullets, family Mugilidae, with 14 spp. definitely recorded, the Ambassidae with 8 spp., the Lutianidae with 11 spp., and the Carangidae with 9 spp. However, only 2 spp. of Carangidae (Caranx sexfasciatus and C. ignobilis) enter Philippine fresh waters in numbers sufficient to be of importance. Notes on frequency, behavior, etc., are given for these and some other noteworthy spp. The most important single fish in the Philippines is Chanos chanos. The largest fish entering Philippine fresh waters is the sawfish Pristis cuspidiatus.

3504. Hoese, Hinton D. 1958. A PARTIALLY ANNOTATED CHECKLIST OF THE MARINE FISHES OF TEXAS. Publ. Inst. Marine Sci. Publ. 5: 314-352; Biological Abstracts, Vol. 35, No. 7, Abst. No. 19969. 1960.

A list of over 400 spp. of fishes known from marine waters of Texas was compiled from the literature and from collections. The list includes spp. taken from the Rio Grande to Sabine Pass offshore to where lines from east and south of these points intersect; this triangle including depths to over 1000 fathoms. A supposed qualitative difference in the fish fauna between the northeastern and northwestern Gulf of Mexico is discussed, and it is concluded that further study is needed before such differences could be considered conclusive. The most recent additions to the fauna have largely come from offshore studies. (Auth.)

3505. Peterson, Melvin J. 1959. THE LAWS OF THE WATERSHED. Cons. Volunteer, 22(127): 1-8; Biological Abstracts, Vol. 35, No. 8, Abst. No. 20023. 1960.

History of watershed problems and legislation in Minn. is reviewed. Most significant event was passage of Minn. Watershed Act of 1955 and 1957, which provides for the organization of watershed districts as a form of local political organization; these groups can qualify for assistance under Federal Act PL 566. A Watershed District thus organized has adequate power and authority to carry on all the practices embraced in a complete watershed program, including promotion of fish, game, and recreational interests. It can deal with various federal and state agencies that promote diverse and conflicting interests. Through it, there is hope that competition and acrimony may be reduced and that all water problems of an area can be handled in the best way, with proper consideration for drainage, reclamation, irrigation, water storage, conservation for agricultural, domestic, industrial, and recreational purposes, sanitation and public health, soil erosion and siltation control, wildlife, and forestry.

3506. Fryer, Geoffrey. 1959. SOME ASPECTS OF EVOLUTION IN LAKE NYASA. Evolution 13(4): 440-451; Biological Abstracts, Vol. 35, No. 8, Abst. No. 20084. 1960.

In spite of its large size Lake Nyasa does not provide either a great diversity of habitats or foods for the fishes which (and particularly the Cichlidae), nevertheless, exhibit the most striking speciation of all the groups present, so speciation cannot have been merely a response to environmental diversity. The great size of the lake, permitting effective isolation by distance, is believed to have been important in evolution. There is evidence to suggest that, contrary to Worthington's views, predation has facilitated and not impeded speciation. Although the cichlid fishes fill numerous niches, adaptive radiation has been restricted in that groups of related species, or even genera, frequently co-exist in the same habitat and often utilize similar foods. Examples are given and comparison made with more typical adaptive radiation in other organisms. Further possible influences of lake level fluctuations on evolution are mentioned. The evolution of plankton feeding in Nyasan fishes has gone hand in hand with the adoption of shoaling habits. Shoaling seems to be a case of ecological neoteny. Mouth brooding is general among the endemic cichlids and is believed to have been important in their evolution and in permitting their coexistence in dense multispecific populations. Preliminary data suggest a correlation between egg size, the number of young brooded, and the type of habitat frequented by the cichlid fishes. Because of the permanence of Lake Nyasa, unusual in freshwater environments, specializations have been encouraged. These restrict species to particular habitats and facilitate isolation by barriers of unsuitable terrain which may be of only small extent. Such conditions are conducive to allopatric speciation. (Auth.)

3507. Cassie, R. Morrison. 1959. MICRODISTRIBUTION OF PLANKTON. New Zealand Jour. Sci. 2(3): 398-409; Biological Abstracts, Vol. 35, No. 8, Abst. No. 20281. 1960.

A sampling frame has been constructed to take simultaneously 24 plankton samples of 800 ml volume, at spatial intervals of 10 cm in a horizontal plane. Tests of departure from randomness of sample counts are applied. Coscinodiscus gigas, with a mean of over 50 cells/sample is highly over-dispersed, but nonrandomness cannot always be detected in zooplankton species, where the mean is in all cases less than 3. It is concluded that over-dispersion is likely to be present in any plankton population, regardless of the spatial scale at which it is investigated, but that where the mean is less than unity it will commonly be necessary to take several hundred samples before significant departure from random can be detected. Further research should preferably be directed toward the casual

factors inducing aggregation rather than to the detection and description of non-random patterns. (Auth. summ.).

3508. Duwe, Arthur E. 1959. THE DIFFERENTIATION OF THE HEART IN THE GREEN SUNFISH, LEPOMIS CYANELLUS. Turtox News 37(12): 290-291; Biological Abstracts, Vol. 35, No. 8, Abst. No. 20693. 1960.

Development of a chambered heart from a tubular heart is described and illustrated. (R. W. D.)

3509. Curd, Milton R. 1959. THE MORPHOLOGY OF ABNORMAL LATERAL-LINE CANALS IN THE CENTRARCHID FISH LEPOMIS HUMILIS (GIRARD). Proc. Oklahoma Acad. Sci. 39:70-75; Biological Abstracts, Vol. 35, No. 8, Abst. No. 21402. 1960.

Examination of 2215 specimens of L. humilis from the Verdigris River in Oklahoma revealed 127 specimens with variable portions of the lateral-line canals in the form of open grooves. Microscope sections and specimens stained with alizarin red S were used to determine the morphology of soft and skeletal tissues. The extent of the abnormality varies up to 90% of the system. The infraorbital, operculomandibular and supratemporal are the canals most frequently open. The absence of soft tissues over the canals is dependent upon the absence of bone. The cause of this abnormality was not determined. (Auth.)

3510. Ohara, Tomâtoshi. 1958. A STUDY OF THE SACCUS VASCULOSUS OF FISHES. (In Japanese with English summ.) Igaku Kenkyu (Acta Medica) 28(3): 750-773; Biological Abstracts, Vol. 35, No. 8, Abst. No. 21420. 1960.

The saccus vasculosus of fishes was studied macroscopically and microscopically. The author found no relation between its size and the habits of fishes. The structure of the saccus vasculosae observed is of the same pattern. The author assumes from its structure that it has sensory ability as a part of its function. (Auth. summ.)

3511. Heukelekian, H., et al. 1959. A REVIEW OF THE LITERATURE OF 1958 ON SEWAGE WASTE TREATMENT, AND WATER POLLUTION. Sewage and Indust. Wastes 31(7): 763-803; Biological Abstracts, Vol. 35, No. 8, Abst. No. 31773. 1960.

The literature pertaining to water pollution is reviewed, covering 235 references. Subjects covered include pollution surveys and investigations, fish kills, water-wastes, radioactive wastes, microbiology, slime growths, oxygen sag and stream self-purification, stream studies and surveys, stream standards, effects on water supplies, abatement and control. (I. G.)

3512. Graham, Jay E. 1959. CREATION OF AN AQUATIC WILDLIFE HABITAT BY MOSQUITO SOURCE REDUCTION. Proc. Utah Acad. Sci., Arts and Letters. 36: 81-82; Biological Abstracts, Vol. 35, No. 8, Abst. No. 22472. 1960.

This paper reports the conversion of a relatively small mosquito larval habitat into good pasture land with ponds that are now used to rear trout. Other species of fish could be reared in these ponds if so desired. (Auth. summ.)

3513. Buzzati-Traverso, Adriano A. 1958. GENETIC PROBLEMS OF MARINE BIOLOGY (GENETISCHE PROBLEME DER MARINEN BIOLOGIE.) Rev. Suisse Zool. 65(2): 461-484; Biological Abstracts, Vol. 35, No. 9, Abst. No. 22814. 1960.

This is a thorough review article which deals with the following genetic problems of marine biology: (1) classical genetic studies (Mendelian analyses) of marine animals; (2) sex determination and chromosome structure; (3) species formation and evolution; (4) analyses of marine ecological systems with the aid of genetic-bacteriologic methods. (MDS)

3514. Blaxter, J. H. S., and B. B. Parrish. 1958. THE EFFECT OF ARTIFICIAL LIGHTS ON FISH AND OTHER MARINE ORGANISMS AT SEA. Marine Res. Ser. Scottish Home Dept. 1958(2): 1-24; Biological Abstracts, Vol. 35, No. 9, Abst. No. 22959.

Experiments were carried out with underwater lights from 15 to 2000 watts. The aggregations of fish obtained and their reaction to changes in light intensity and to vertical movement of the lights were scanned by fixed and portable echosounders. The aggregations were sampled by explosives, various nets, and photographs taken by underwater camera. The main species aggregated were whiting (Gadus merlangus) 10-40 cm long, herring (Clupea harengus) 5-25 cm long and sprats (Clupea sprattus) 5-15 cm long. The vertical movements of these fish in response to lights were studied in relation to pressure changes and swimming speeds. The value of lights for commercial fishing in Scotland is assessed. (Auth.)

3515. Fields, P. E., A. K. Murray, D. E. Johnson, and G. L. Finger. 1958. GUIDING MIGRANT SALMON BY LIGHT REPULSION AND ATTRACTION IN FAST AND TURBID WATER. Univ. Washington Sch. Fish. Tech. Rept. 36/41. vii + 44; Biological Abstracts, Vol. 35, No. 9, Abst. No. 22966. 1960.

Two years of field studies on the White River, Washington with young silver and chinook salmon (Oncorhynchus kisutch and O. tshawytscha) and steelhead trout (Salmo gairdneri) are described. Strings of bright lights above water produced statistically significant deflection of young salmon in average velocities of 6 feet per second in relatively clear water, but failed in turbid glacial water (minimum light transmission only 42% in one cm of water). Very dim light (.015 foot candle or less at the surface) was an effective attraction stimulus in both clear and turbid water at low velocities where the fish were required to approach the surface to escape from a shallow impoundment.

Intensity, not color, seemed to be the important factor. The addition of various electrical and auditory stimuli did not increase the effectiveness of the guidance obtained by either light repulsion or attraction methods. (Auth.)

3516. Johnson, D. E., P. E. Fields, P. S. Karekar, and G. L. Finger. 1958. CONDITIONS UNDER WHICH LIGHT ATTRACTS AND REPELS PREMIGRATORY SALMON IN CLEAR AND TURBID, STILL AND RUNNING WATER. Univ. Washington Sch. Fish., Tech. Rept. 42. 1-15; Biological Abstracts, Vol. 35, No. 9, Abst. No. 22967. 1960.

A number of studies in the experimental flume of the fish behavior laboratory are described. Young silver salmon (Oncorhynchus kisutch) were significantly attracted in clear, still water to lights with intensities (measured at the surface one foot from the source) ranging from .000025 to .035 foot candles. At 1.3 ft. cdls. attraction was not present. Dim overwater lights, colored or white, sequentially extinguished toward the weir attracted 85% of the fish over the weir in 10 minutes in either clear or turbid running water, with none during the dark control runs. Fish moved only in the shaded portion of the weir when a bright light burned downstream. (Auth.)

3517. Johnson, Donald E., and Paul E. Fields. 1959. THE ORIENTATION OF SEXUALLY MATURE SALMON TO SIMULATED STAR PATTERNS. Univ. Washington Sch. Fish., Tech. Rept. 48 1-8; Biological Abstracts, Vol. 35, No. 9, Abst. No. 22968. 1960.

Simulated star patterns representative of latitude 30°N and 60°N were each presented for 3-hour periods on a hemispherical dome covering a circular tank to 8 sexually mature male chinook salmon (Oncorhynchus tschawytscha). These fish had returned to the College of Fisheries as 3-year-olds after 2 years in salt water. Overhead still pictures were taken of individual fish at 6-minute intervals by means of a stroboflash unit, and bodily orientations so obtained compared with similar orientations obtained under conditions of complete darkness for an equal period. There was no discernible bodily orientation under either of the star patterns or under the dark condition. It is not known whether a characteristic orientation would have occurred had the fish been tested in the open ocean instead of up river after completion of their spawning migration. (Auth.)

3518. Gihr, Margarethe. 1957. ON THE DEVELOPMENT OF THE PIKE. (ZHUR ENTWICKLUNG DES HECHTES.) Rev. Suisse Zool. 64(3): 355-474; Biological Abstracts, Vol. 35, No. 9, Abst. No. 24302. 1960.

Artificially fertilized pike roe from a hatchery was used, supplemented by a complete fixed series of pike materials. The author describes the morphology of the embryo, as classified in 10 stadia; morphology of the post-embryonic stage, during which the fish attaches itself to some nearby object. In this species, unlike other middle European fish, there is a diffuse distribution of blood in the yolk-sac. Toward the end of this stage the fish begins filling its air bladder with air and manages, with much effort, to reach the water surface occasionally, only to fall again to the bottom. Eventually the bladder is completely full, and the fish now rises vertically to the surface and assumes a horizontal swimming position. This is the start of the free phase. The morphology of this phase is then described, for each successive stadium. A series of statistical tests was undertaken on the relative growth rates of various parts of the body, by means of the allometric formula $y = bx^a$, which shows that in stadium IV of the free phase, practically all parts grow isometrically. The author therefore considers that despite absence of sexual maturity at this stadium, adulthood has been reached. (MDS)

3519. Prost, M. 1959. INVESTIGATIONS ON THE INFLUENCE OF SALINITY ON THE MONOGENOIDEA FAUNA OF FISHES. (BADANIA NAD WPLYWEN ZASOLENIA WODY NA FAUNE MONOGENOIDEA RYB.) (English summary) Acta Parasitol. Polonica 7(23/35): 615-630; Biological Abstracts, Vol. 35, No. 9, Abst. No. 25424. 1960.

The author studied Monogenoidea infection in fishes in Martwa Wisla (Vistula), salinity 0.1 - 0.4%, Lake Ptasi Raj, salinity about 0.2%, Lake Karaski, salinity about 0.2%, the coastal zone of the Baltic Sea, salinity 0.6 - 0.7% and Vistula Bay, salinity 0.25 - 0.4%. In general, increasing salt concentrations were unfavorable to parasitism by the Monogenoidea, however this was not true for Vistula Bay. The effect of salinity was considered an individual species characteristic of the parasite. The species tolerating the narrowest range of salinity were Dactylogyrus vistulae, D. formosus, D. vastator and D. intermedius and those tolerating the greatest range were D. difformis, Diplozoon paradoxum and to a lesser degree, Dactylogyrus crucifer. In support of Dubinin (1948) the author thought that the high sulfate level in Martwa Wisla adversely affected fish parasites there. (MDS)

3520. Deelder, C. L. 1958. SOME REMARKS ON THE STAY OF FISHES UNDER AND IN ICE. (ENIGE OPMERKINGEN BETREFFENDE HET VERBLIJF VAN VIS ONDER EN IN IJS.) Natura 55: 4-6; Biological Abstracts, Vol. 35, No. 10, Abst. No. 25895. 1960.

A short review of previous experiments is followed by a description of the behavior of Gambusia in water of 0.2°-0.3°C. Movements disappear gradually, fishes rest motionless on the bottom, only the mouth and the opercula move. Irritation results in slight, uncoordinated movements. After 45-65 minutes, respiratory movements stop. The fishes then can be kept alive above water if they are placed on the ice surface. In fish placed in water of room temperature, the normal activity usually returns. Some specimens die during the treatment, others lose their sense of equilibrium. Carps behave differently,

they need a temperature of -3°C before becoming motionless. (J.H.S.)

3521. Cushing, D. H. 1959. ON THE NATURE OF PRODUCTION IN THE SEA. Fish. Invest. Min. Agric., Fish. and Food (Gt. Brit.) Ser. II. 22(6): 1-40; Biological Abstracts, Vol. 35, No. 10, Abst. No. 25964. 1960.

The production of living matter in the sea is based on the production of algae. Numbers of algae may be estimated by net hauls, estimation of chlorophyll or by sedimentation from a preserved water sample. Other determining factors include the reproductive rate which may be estimated indirectly by measuring photosynthesis, the natural mortality rate estimated from counts of empty diatom frustules and grazing mortality. The author attempts to construct a model to explain the spring outburst of plankton production using theoretical algal reproductive and herbivore grazing rates. The direct role of nutrients in algal production is considered of minimal importance. (MDS)

3522. Hoffman, C. H. 1959. ARE THE INSECTICIDES REQUIRED FOR INSECT CONTROL HAZARDOUS TO AQUATIC LIFE? Agric. Chem. 14(6): 34-36. 111; Biological Abstracts, Vol. 35, No. 10, Abst. No. 25982. 1960.

The author studied the side effects of applications of DDT over forests on both terrestrial and aquatic insect populations. Loss of fish and aquatic birds was due to misuse of insecticides, such as cleaning of spray equipment in ponds, etc. The small loss to aquatic life is more than offset by the gains made in saving whole forests from insect pests. Yearling brook trout collected in a stream 1 year after treatment with DDT showed survival of young-of-the-year fish; brook trout captured 16 months after spraying were found to contain DDT. In 1957 streams were checked for effects of the gypsy moth spray program. The claims of losses could not be verified by the trained workers. In the court cases in 1957 where 14 plaintiffs from Long Island, N. Y. sought to restrain the U. S. Dept. of Agriculture from further spraying, 50 witnesses testified to the bad effects of spraying. The overall decision was in favor of the defendants. Judge Bruschhausen stated the plaintiffs did not sustain their claim that spraying causes loss of birds, fish, bees, and insects. Such losses indeed have been inconsequential. (MDS)

3523. Kolosova, N. N. 1957. HYDROBIOLOGICAL AND HYDROCHEMICAL CHARACTERISTICS OF THE ORLOVO, BESTOLKOVYY AND YERYKLY LAKES. Tr. Kuybyshevsk Med. Inst. 1957(7): 86-100; Biological Abstracts, Vol. 35, No. 10, Abst. No. 25984. 1960.

An unfavorable gaseous cycle of the lakes prevents the breeding of valuable fish in them. The regulation of the water table in the lakes creates conditions which prevent overgrowth and aids the organization of rational fisheries.

3524. Woker, H., and K. Wuhrmann. 1957. THE REACTION OF BROOK FAUNA TO POISONING OF WATER. Rev. Suisse Zool. 64(2): 253-262; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26003. 1960.

A study was made of the effect of temporary water poisoning upon biocenosis. A control stretch of water was poisoned by discharging a chlorine bomb for a period of 5 hours, then neutralizing the dissolved chlorine by means of sodium thiosulfate. Measurement of the insect and worm population density showed a sharp drop at first, but substantial recovery 2 weeks later, although in varying proportions for different fauna. The fish (trout) population density was reduced, partly from direct poisoning, partly from lack of food. The brook was restocked 2 weeks later, and subsequent counts showed no permanent effects upon biocenosis. (MDS)

3525. Zafar, A. R. 1959. TAXONOMY OF LAKES. Hydrobiologia 13(3): 287-299; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26004. 1960.

A scheme to classify waters on the basis of Pearsall's basic ratio and N, P, and humus contents has been proposed. It has also been pointed out that if lakes are to be differentiated on the basis of their ecology, various categories will have to be created since no two freshwater bodies can be expected to be exactly identical in their ecological behavior. This, obviously leads one to think in terms of coining a separate ecological nomenclature for various lake-types within the frame-work of trophic system. In this paper an attempt has been made to develop a system of nomenclature more or less similar to the binomial system of Linnaeus. The proposed names are composed of three components, each almost self-explanatory, and these put together provide relevant ecological information pertaining to a lake. (Auth. summ.)

3526. Bass, J. Carl, and Carl D. Riggs. 1959. AGE AND GROWTH OF THE RIVER CARPSUCKER, CARPIODES CARPIO RAFINESQUE, OF LAKE TEXOMA. Proc. Oklahoma Acad Sci. 39:50-69; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26010. 1960.

By the scale method, ages were determined for 604 river carpsuckers collected at 8 different localities on the 95,000 acre Lake Texoma. The body-scale relationship was expressed by the equation $L = -.00615 + (1.18954)S$. Average calculated total lengths for fish of age-groups I to VI were 3.6, 6.8, 9.4, 11.9, 14.4, and 15.0 inches respectively; average lengths for females were slightly higher than those of males of the same age-groups. The length-weight relationship was determined using the formula $W - CL^n$. Condition factors C(TL) were calculated; the mean factor was 45.3 (range - 39.2-52.4) and the usual increase in coefficient of condition with age and size was not evident. (Auth.)

3527. Crutchfield, James A. 1959. BIOLOGICAL AND ECONOMIC ASPECTS OF FISHERIES MANAGEMENT. PROCEEDINGS OF A CONFERENCE HELD

UNDER THE AUSPICES OF THE COLLEGE OF FISHERIES AND THE DEPARTMENT OF ECONOMICS OF THE UNIVERSITY OF WASHINGTON AT SEATTLE, FEBRUARY 17-19, 1959. Paper-bound University of Washington Press: Seattle, 160 pgs.; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26019. 1960.

The papers and discussions are under 4 subdivisions: Biological and economic aspects of fishery management, halibut fishery management, salmon management in Alaska, and international trade policies and their relation to fisheries.

3528. Darnell, Rezneat M. 1958. FOOD HABITS OF FISHES AND LARGER INVERTEBRATES OF LAKE PONTCHARTRAIN, LOUISIANA, AN ESTUARINE COMMUNITY. Publ. Inst. Marine Sci. Publ. 5:353-416; Biological Abstracts, Vol. 35, No. 10, Abstract No. 26020. 1960.

Quantitative food studies were carried out on 35 of the most important species of fishes and invertebrates comprising the estuarine community. A definite ontogenetic progression of food stages was recognizable in many species, and most were considered to be omnivorous. Organic detritus was prominent in the diet of most species. Two partial food chains (planktonic and benthonic) were found to support the top predators. Distinct "trophic levels" among the consumers were not recognizable. The physical environment of Lake Pontchartrain is also characterized. (Auth.)

3529. Davis, James T. 1959. BIOLOGICAL ASSAY OF HERBICIDES FOR FISH TOXICITY. Weeds 7(4): 397-404; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26021. 1960.

Bluegill sunfish (Lepomis macrochirus) and largemouth bass (Micropterus salmoides) were used as test organisms. The following compounds were included: dimethylamine salt of 2, 4-dichlorophenoxyacetic acid (2, 4-D); isopropyl N-(3-chlorophenyl) carbamate (CIPC); hexachlorocyclopentadiene (C-56); dimethylamine salt of 4-(2-methyl-4-chlorophenoxy) butyric acid (4-(MCPB)); dimethylamine salt of 4-(2, 4-dochlorophenoxy) butyric acid (4-(2, 4-DB)); 1, 2-dibromo-3-chloropropane; 1, 2-dibromoethane (EDB); mixed isomers of trichlorobenzoid acid, predominately 2, 3, 6-TBA, HC1281-S, (2, 3, 6-TBA); and mixed isomers of TBA, 2, 3, 5-trichlorobenzoic acid 16.3%, 2, 3, 6-trichlorobenzoic acid 7.8%, 2, 3, 5, 6-tetrachlorobenzoic acid 36.4%, other isomers, 39.5%, ACP-M-323, (2, 3, 5-TBA). A median tolerance limit (TL_m) was established for each chemical. The notation TL_m is essentially the inverse of the LD_{50} notation used in other biological investigations in that it indicates the concentration at which just 50% of the test animals are able to survive for a specific exposure period. The TL_m after 24 hours of exposure was of the order of 1500 ppm for 2, 3, 6-TBA, 350 for 2, 4-D, 150 for 2, 3, 5-TBA, 50 for 1, 2-dibromo-3-chloropropane, 20 for EDB, 15 for 4-(MCPB), and 10 for 4-(2, 4-DB) and CIPC. (J. v O.)

3530. Fields, Paul E., Donald E. Johnson, and Sayed Z. El-Sayed. 1959. THE 1958-59 McNARY DAM LIGHT GUIDING STUDIES. Univ. Washington Sch. Fish., Tech. Rept. 50 vi + 24 pp.; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26025. 1960.

Experiments involving the use of above water and underwater electric lights at a high dam on the Columbia River to control the behavior of downstream migrating salmon and trout are reported. The most recent attraction method used a single clear 200 W incandescent lamp placed 6 inches above the water surface to attract and concentrate migrants in one half of a 6-foot wide trap. It was an effective attraction stimulus when used above the lip of a 17-inch overfall from the relatively calm, clear, deep water in front of the powerhouse, but repelled the migrants at a depth of 15 feet in another location when the velocities were 0.5 feet/second and higher. It is believed that repulsion occurs whenever the fish are carried toward the light source at a rate exceeding their speed of retinal adaptation. Over 90% of the migrants appeared to be traveling in the top 30 feet of water. Neither above water nor underwater lights were successful in forcing these migrants to use an exit 50 feet deep in preference to one only 15 feet under the surface. Predation by sea gulls was apparently related to the manner in which the spillway gates of the dam were operated. (Auth.)

3531. Gunter, G. 1958. POPULATION STUDIES OF THE SHALLOW WATER FISHES OF AN OUTER BEACH IN SOUTH TEXAS. Publ. Inst. Marine Sci. Publ. 5:186-193; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26026. 1960.

A study of fish populations was made in Aransas and Corpus Christi passes and the outer beach of Mustang Island. Eight stations were sampled by small-mesh seine hauls 18 times in 3 different years, 144 hauls being made. The fishes taken were all small and only 11 were greater than 100 mm in length. The total catch, representing 44 species, was 10,633 fishes. The most abundant species were: Trachinotus carolinus, Harengula pensacolae, Mugil curema, Menidia beryllina, Fundulus similis and Anchoa mitchilli. Five species, T. carolinas, H. pensacolae, M. curema, A. mitchilli and Micropogon undulatus, made up 82.5% of the beach catch. The last 3 are common bay fishes, but the first 2 are abundant only on the beach and in outside waters. Fishes were most abundant on the beach in the spring and summer, less abundant in late summer and fall, and quite scarce in late fall and early winter. The Gulf beach is primarily a habitat of young pompano, T. carolinus, and the sardine, H. pensacolae; these two fishes made up 69.3% of the catch. Comparisons made with seine hauls of earlier years showed some change of the populations based upon fluctuations of a few species. The dominant species of the beach were the same species or species cognate to those of North Carolina beaches, and they were all cognates of those reported from New England beaches. All Gobionellus boleosoma, nearly all Cyprinodon variegatus and Fundulus similis, and the great majority of Menidia beryllina, were taken in the passes rather than on the outside beach. More

fishes were caught per haul at the stations inside the passes than on the open beach, and the species were somewhat different. Four species, H. pensacolae, Mugil curema, M. beryllina, and F. similis made up 87.0% of the pass catch. The work confirms previous findings that young pompano are recruited into the population over an extended period during warm months. It also supports reports of a double spawning peak for H. pensacolae. Small specimens of the filefish, Stephanolepis hispidus, are reported from the beach for the first time.

3532. Johnson, Donald E., and Paul E. Fields. 1959. THE EFFECTIVENESS OF AN ELECTRIC HOT-WIRE BRANDING TECHNIQUE FOR MARKING FINGERLING STEELHEAD TROUT. Univ. Washington Sch. Fish., Tech. Rept. 47, 1-5; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26033. 1960.

A total of 260 fingerling steelhead trout (Salmo gairdneri) were anesthetized with M.S. 222 and 8 experimental groups were branded with either 1 or 2 marks in 1 of 6 body areas with a wire heated to white heat by a small impressed AC current. A 9th group was left unmarked as controls. Mortality records were kept, and 5 months later each surviving fish was examined for the brand mark. None of the 234 surviving fish showed a distinctive mark. The mortality in the marked group was no greater than that in the control group. (Auth.)

3533. Kristensen, I. 1958. THE INHABITANTS OF THE WADDENSEA. (DE BEWONERS VAN DE WADDENZEE.) Natura (Eindhoven) 55:112-114; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26038. 1960.

Estimates of the economic value of the Dutch Waddensea (fisheries + protein production for nutrition of young fish and birds). Embankment of the Waddensea would have serious economic influence upon the population density of fishes and birds of neighboring areas. (J.H.S.)

3534. Muncy, R. Jess. 1959. AGE AND GROWTH OF CHANNEL CATFISH FROM THE DES MOINES RIVER, BOONE COUNTY, IOWA, 1955 AND 1956. Iowa State Jour. Sci. 34(2): 127-137; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26047. 1960.

Age and growth of Ictalurus punctatus were determined by 3 independent methods. Calculated lengths at the 1st 2 annuli on pectoral spine cross-sections were shorter than modes for length frequency data. Several factors were encountered in the spine technique which could cause such variations. Recorded increases in total length of some tagged channel catfish exceeded the calculated average increments. In general, the 3 methods substantiated each other. Less growth occurred during 1955 than 1956 probably due to decreasing summer water levels in 1955. Weight increases more rapidly than the cube of the total length. The number of eggs/mature female was 2682-9731, and increased with age, length and weight of the fish. (Auth. abst.)

3535. Rae, Bennet B. 1959. HALIBUT-OBSERVATIONS ON ITS SIZE AT FIRST MATURITY, SEX RATIO AND LENGTH/WEIGHT RELATIONSHIP. Marine Res. Ser. Scottish Home Dept. 1959(4): 1-19. 1959; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26057. 1960.

Observations on commercial catches of halibut landed at Aberdeen from the northeast Atlantic form the basis of this paper. Male halibut spawn for the 1st time at sizes ranging from 71-102 cm and females from 99-137 cm. During their 1st few years of life, male and female fish occur in about equal numbers but later (length 124-152 cm) females are more than 3 times as numerous as males and from 152 cm upwards all the fish examined were females. The relationship of length to weight is studied from the regional and seasonal aspects. The conclusions are considered in relation to existing fishery regulations and the advantages to be gained from possible conservation measures with regard to halibut are discussed. (Author)

3536. Rodriguez-Roda, Julio. 1959. APPEARANCE ON THE ATLANTIC COAST OF SOUTHWEST SPAIN OF TUNA FISH TAGGED IN NORWAY. (APARICION EN LA COSTA SUDATLANTICA ESPANOLA DE ATUNES MARCODOS EN NORUEGA.) (English summary) Invest. Pesq. 14:115-119; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26058. 1960.

Three specimens of Thunnus thynnus tagged near Bergen, in September 1958, were caught in southwest Spain in June and July 1959. (R.M.)

3537. Saville, Alan. 1956. EGGS AND LARVAE OF HADDOCK (GADUS AEGLEFINUS L.) AT FAROE. Marine Res. Ser. Scottish Home Dept. 1956(4): 1-27; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26061. 1960.

Hensen and 2 m ring net samples were collected over the Faroe Plateau during cruises in the spring of the years 1950-1953. In samples of mixed cod and haddock eggs the proportion of each species can be estimated by probability paper analysis of the size frequency of the whole sample. The spawning season extends from March to mid-May coinciding with peak commercial catches of haddock. The major areas of spawning activity are defined and related to the distribution of adult fish. The growth rate of haddock larvae is shown to be best fitted by a daily increase of 0.012 in the logarithm of the length. The haddock egg production of the area is assessed for each of the 4 years and related to the size of the spawning stock. The abundance of larvae and their rates of mortality are discussed in relation to brood recruitment. The lower than average recruitment of the 1950 brood would appear to have been caused by a higher than normal mortality throughout the entire planktonic phase. (Auth.)

3538. Springer, Victor G., and Jacques Pirson. 1958. FLUCTUATIONS IN THE RELATIVE ABUNDANCE OF SPORT FISHES AS INDICATED BY THE CATCH AT PORT ARANSAS, TEXAS 1952-1956. Publ. Inst. Marine Sci. Publ. 5: 169-185; Biological

Abstracts, Vol. 35, No. 10, Abst. No. 26065. 1960.

Weekly catch records of certain sport fishes for a 5-year period were graphed. Reported occurrence of catch peaks during particular months for certain species are considered to indicate an index of abundance for the species. These peaks are interpreted in terms of fishing pressure, weather, possible biological implications, and bearing on the economy of a community dependent upon sport fishing. (Author)

3539. Yamashita, Daniel T., and Kenneth D. Waldron. 1959. TAGGING OF SKIPJACK IN HAWAIIAN WATERS. Pacific Sci. 13(4): 342-348; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26076. 1960.

A concentrated effort to tag and release skipjack (Katsuwonus pelamis) in Hawaiian waters was initiated in 1954. During 1954-1956, 1961 skipjack were tagged with the California type G tag. The low recovery rate of 0.6%, or 12 fish, may have been due to tagging mortality, predation, and the movement of fish beyond the limits of the fishery. Three of the 12 recoveries were from the stomachs of tunas caught on longline. All recoveries were made near the points of release and none showed inter-island movement. (Auth.)

3540. Robertson, O. H., and B. C. Wexler, 1960. HISTOLOGICAL CHANGES IN THE ORGANS AND TISSUES OF MIGRATING AND SPAWNING PACIFIC SALMON (GENUS ONCORHYNCHUS). Endocrinology 66(2): 222-239; Biological Abstracts, Vol. 35, No. 10, Abst. No. 26615. 1960.

A histological study was made of the various organs and tissues of the Pacific salmon at successive stages of sexual maturation from the sea to the spawning grounds. Pronounced changes were found in the body structures of the spawning salmon prior to death. These consisted principally of degeneration with or without atrophy as shown by the stomach, liver, spleen, thymus, gonads, pituitary, kidney and cardiovascular system. On the contrary, certain organs exhibited hypertrophy and hyperplasia, e.g., adrenal, pancreatic islets and skin. The inception of some of the above changes was detected several months before full sexual maturity. Comparison with the histological alterations occurring in Cushing's syndrome, experimental hyperadrenocorticism and aging, suggested that many of the tissue changes found in the salmon could be ascribed to the effects of hyperactivity of the adrenal gland. Previous finding of high concentrations of 17-OHCS in the plasma of spawning salmon lends support to this inference. (Auth. abst.)

3541. Linder, Allan D. 1959. THE AMERICAN PERCID FISHES AMMOCRYPTA CLARA JORDAN AND MEEK AND AMMOCRYPTA PELLUCIDA (BAIRD). Southwestern Nat. 4(4): 176-184; Biological Abstracts, Vol. 35, No. 10, Abst. No. 28226. 1960.

The two spp. Ammocrypta clara Jordan and Meek and Ammocrypta pellucida (Baird), are shown to be distinct on the basis of scale counts, opercle structure and pigmentation. The original descriptions of these 2 spp. were based on syntypes. Lectotypes are designated and described. (Auth. abst.)

3542. Stokell, G. 1969. THE STRUCTURAL CHARACTERS OF TE ANAU SALMON. Trans. Roy. Soc. New Zealand 87(3/4): 255-263; Biological Abstracts, Vol. 35, No. 10, Abst. No. 28231. 1960.

Comparison of structural features shows that the freshwater-dwelling salmon of Lake Te Anau agree more closely with normal Salmo salar than with the lake-dwelling forms known as ouananiche and sebago. The conclusion that the Te Anau salmon have been derived from sea-going salmon is supported by analagous structural modifications in lake-dwelling Oncorhynchus tshawytscha. The American forms, ouananiche and sebago, which have been regarded as subspecies or varieties of Salmo salar, are reinstated as a distinct species under the original name of Salmo sebago Girard. (Auth. abst.)

3543. Edwards, R. W., and M. W. Brown. 1960. AN AERIAL PHOTOGRAPHIC METHOD FOR STUDYING THE DISTRIBUTION OF AQUATIC MACROPHYTES IN SHALLOW WATERS. Jour. Ecol. 48(1): 160-162; Biological Abstracts, Vol. 35, No. 11, Abst No. 28410. 1960.

A method of photographing the distribution of macrophytes in shallow bodies of water is described, The apparatus consists of an electrically operated and stabilized camera suspended from a polyethylene baloon filled with hydrogen. (Auth.)

3544. Geagan, Donald W., and Charles M. Fuss, Jr. 1959. THERMAL AND CHEMICAL STRATIFICATION OF SOME LOUISIANA LAKES. Proc. Louisiana Acad. Sci. 22:32-43; Biological Abstracts, Vol. 35, No. 11, Abst. No. 28635. 1960.

Waters studied were Lake Providence and Lake Bruin (Mississippi ox-bow lakes), Lake Chicot (shallow impoundment), and Holloway's Pond (former gravel pit). Lake Providence (max. depth 12.2 m and Lake Bruin (max. depth 15.8 m showed definite summer stratification with clear epilimnion, thermocline, and hypolimnion. Lake Chicot (max. depth 2.6 m and Holloway's Pond (max. depth 4.6 m showed indefinite stratification with a poorly defined thermocline. (G.H.P.)

3545. Lebedeva, G. D. 1957. PLANKTON AS AN INDICATOR OF POLLUTION OF SWEET WATER RESERVOIRS BY RADIOACTIVE SUBSTANCES. Med. Radio. 2(6): 65-69; Biological Abstracts, Vol. 35, No. 11, Abst. No. 28636. 1960.

A study was conducted on accumulation of Sr^{90} from water by Daphnia magna, Diaptomus amblyodon, and Scenedesmus quadricauda, and also by washing Sr^{90} from Daphnia by clean water. It was shown that Daphnia concentrate the isotopos, found in water in negligible quantities (about 10-12), to a very high degree (about 300 thousand-fold) and very rapidly (in

5 minutes). When Daphnia is transferred to pure water, from 2 - 25% of initial activity remains for 10 days. Diaptomus and Scenedesmus also produce an increased concentration by comparison with water, but less intensely than Daphnia. The plankton organisms can be used for detecting pollution of reservoirs by radioactive isotopes,

3546. Phillips, Ronald C., and L. A. Whitford. 1959. A QUANTITATIVE STUDY OF THE SUMMER PHYTOPLANKTON IN FOUR CENTRAL NORTH CAROLINA PONDS. Hydrobiologia 14(2): 147-154; Biological Abstracts, Vol. 35, No. 11, Abst. No. 28639. 1960.

Phytoplankton counts were carried out using the Sedgwick-Rafter methods during the summer of 1957 to discover whether any correlation exists between changes in bound phosphorus concentration and phytoplankton numbers. No correlation was found, as was reported elsewhere, and this paper reports on the summer phytoplankton in relation to other habitat factors. Populations were low except for brief pulses. One coastal-plain pond had several blooms of blue-green algae. The others supported a typical Caledonian flora: rich in species but low in numbers of individual organisms. There was no clear correlation between the phytoplankton population and any habitat factor except pH. This was probably not direct but an indication of water quality. (K. E. M.)

3547. Steemann, Nielsen E. 1959. INVESTIGATIONS OF PRIMARY PRODUCTION OF THE PLANKTON IN SOME AUSTRIAN ALPINE LAKES. (UNTERSUCHUNGEN UBER DIE PRIMARPRODUKTION DES PLANKTONS IN EINIGEN ALPENSEEN OSTERREICHS. Oikos 10(1): 24-37; Biological Abstracts, Vol. 35, No. 11, Abst. No. 28644. 1960.

Primary production was studied by the C^{14} method in the Lunzer Untersee, with some comparative studies in the Lunzer Obersee, Attersee, and Mondsee. Experimental flasks were exposured from midday to sundown and results were multiplied by 2 to obtain the primary production per day. Seven series of experiments were undertaken at Lunzer Untersee. These indicated a gross production of about 30 g C/m^2 for the year. The limited investigations of the Attersee and Mondsee suggested that these lakes were slightly more productive, but that they were lakes of the same general type. The Lunzer Obersee, however, was more eutrophic, and the nature of the curves shown is very different. The author suspects that a good deal of chemosynthesis takes place in this lake. The production in the Lunzer Untersee is about double that of the Sargasso Sea, signifying that the lake is rather productive. Comparisons of primary production are made with the volume of phytoplankton for Lunzer Untersee and Lunzer Obersee. Phytoplankton counts and measurements were made by Professor F. Ruttner. (C. C. D.)

3548. Wojciechowska, Bozena. 1958. TWO QUANTITATIVE METHODS OF FRY CATCHING. (DWIE METODY POŁOWOW ILOSCIOWYCH NARYBKU.) Ekol. Polska 6(6): 183-203; Biological Abstracts, Vol. 35, No. 11, Abst. No. 28672. 1960.

Described are 2 new methods of catching fry and small fish in quantity and their applicability is analyzed. The 1st method is a modification of net fishing, the net being drawn through a defined area (always the same), and only part of the catch, the so-called "small test sample" is taken for examination. The representative character of the small test sample in relation to the whole catch is checked by comparing of the composition of the species, the numerical ratio of the species concerned, and the variations in body dimensions within each species. The possibility of determining the size of the fish community in reservoir on the basis of the small test sample and the catch from the net is discussed also. It was established that this method is not suitable for faunistic investigation, but it permits a correct estimate of the numerical ratio between the different species and within each species. The observation method is based on the amount of fish visible within an area defined by a frame floating on the surface of the water. It has been established that neither cloudiness, ripples nor the coloring of the bed affects the accuracy of the estimate of the numbers of fish within the frame. This method is unsuitable if used by itself, as it does not give a picture of the composition of the species, but it does permit making a large number of repeat tests without introducing any changes into the environments, and examining differences found by the fish in this environment. Both methods are economical of effort, due to the small quantity of material required for investigation; also they alter the environment only to a very small extent, do not cause overfishing of the population and enable tests to be made from a small area of water. These advantages combine to make these methods convenient for quantitative investigation of the ecology of the fry and small fish in the area of water near the banks. (Auth. summ.)

3549. Kittrell, F. W. 1959. EFFECT OF IMPOUNDMENTS ON DISSOLVED OXYGEN RESOURCES. Sewage and Indust. Wastes 31(9): 1065-1078; Biological Abstracts, Vol. 35, No. 11, Abst. No. 29848. 1960.

The effect of thermal stratification on reaeration characteristics of both storage and main stream reservoirs is considered, and data are presented for a number of field situations. Corrective measures to overcome the effects of reduced oxygen content in the hypolimnion are discussed, including: use of multilevel penstock intakes, high level penstock weirs, special tailrace design, compressed air reaeration, and circulation of reservoir contents by pumping. Research on the latter method is recommended. Forty-two references are appended. (I. G.)

3550. Saha, K. C., D. P. Sen, and S. K. Chakraborty. GAMMEXANE IN THE TREATMENT OF A NEW PARASITIC INFECTION IN FISH. Sci. and Culture 25(2): 159; Biological Abstracts, Vol. 35, No. 11, Abst. No. 30604. 1960.

At the concentration of 1 ppm all the parasites were killed within 24 hours and no other harmful effects were observed. (V. G. P.)

3551. Bach, Michael K. 1960. MASS CULTURE OF EUGLENA GRACILIS. Jour. Protozool. 7(1): 50-52; Biological Abstracts, Vol. 35, No. 12, Abst. No. 30924. 1960.

A method is described whereby large amounts of Euglena cells can be obtained efficiently for enzymological studies. A completely defined, low pH medium which offers relative freedom from contamination is used. The culture equipment is also usable for the mass culture of many other unicellular algae. (Auth synopsis)

3552. Zullig, Hans. 1959. A NEW CLOSING FLASK WITH AUTOMATIC BOTTOM-RELEASE MECHANISM. (EINE NEUE SCHOPFFLASCHE MIT AUTOMATISCHER BODEN-AUSLOSEVORRICHTUNG.) Schweiz. Zeitschr. Hydrol. 21(1): 109-111; Biological Abstracts, Vol. 35, No. 12, Abst. No. 30941. 1960.

An apparatus is described and figured, similar in design to the Friedinger bailing bottle. By means of an additional measuring rod, water tests may be made free from sediment immediately above the water bottom. (From auth. summ.)

3553. Hagelin, Lars-Olof. 1959. FURTHER AQUARIUM OBSERVATIONS ON THE SPAWNING HABITS OF THE RIVER LAMPREY (PETROMYZON FLUVIATILIS). Oikos 10(1): 50-64; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31104. 1960.

The previous observations reported in Oikos by Hagelin and Steffner (1958) are supplemented by detailed descriptions based on a motion picture film of spawning in Petromyzon fluviatilis. Spawning did not occur in a large plastic tank devoid of gravel, but occurred readily in the filming tank where gravel was present, and in the plastic tank after a handful of gravel had been inserted. (C. C. D.)

3554. Horstmann, Ernst. 1959. STUDIES ON SHOALS BY USE OF AN OPTOMOTOR REACTION OF M. CEPHALUS. (SCHWARMSTUDIEN UNTER AUSNUTZUNG EINER OPTOMOTORISCHEN REAKTION BEI MUGIL CEPHALUS.) Pubb. Staz. Zool. Napoli 31(1): 25-35; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31105. 1960.

The maintenance of position by individual fish in shoals has been shown to depend upon an appreciation of position by eye movements. Speed and magnitude of movements of objects in the field of vision have great effects on the optomotor reaction. Repeatability and intensity of the action is affected by the number of fish in the vicinity. (M. S. L.)

3555. Verheijen, F. J. 1959. ABSENCE OF ALARM SUBSTANCE IN SOME CLUPEIDS. Pubb. Staz. Zool. Napoli 31(1): 146-152; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31111. 1960.

A number of fishes show an alarm or fright reaction in response to skin extracts from their own species. This reaction is often associated with the schooling of such fish. Skin extracts of Engraulis encrasiocholus, the anchovy, Clupea pilchardus, the sardine, Clupea harengus, the herring and the sprat do not cause fright reactions in these fish. Schools under active predation by other fish do not break up, and the absence of an alarm substance is reflected by the habit of cannibalism shown by these clupeids. (M. S. L.)

3556. Bertullo, V. H., and F. Perez-Hettich. 1958. SYNERGIZED ROTENONE IN THE CONTROL OF H. MALABARICUS. (CONTROL DE LA TARAFA, HOPILAS MALABARICUS, POR MEDIO DE LA ROTENONA SINERGIZIDA.) An. Fac. Vet. 8(6): 145-150; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31133. 1960.

In vitro experiments with the predator fish H. malabaricus. (J. E. M.)

3557. Lambou, Victor W. 1959. FISH POPULATIONS OF THE STREAMS OF THE RED DIRT GAME MANAGEMENT AREA, NATCHITOCHES PARISH, LOUISIANA. Proc. Louisiana Acad. Sci. 22: 46-53; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31142. 1960.

Eighteen species of fish were found: Micropterus salmoides, M. punctulatus, Esox americanus vermiculatus, Semotilus atromaculatus, Lepomis macrochirus, L. megalotis, L. cyanellus, L. punctatus, Chaenobryttus coronarius, Centrarchus macropterus, Elassoma zonatum, Aphredoderus sayanus, Ictalurus natalis, Schilbeodes nocturnus, Erimyzon oblongus, Moxostoma peocilurum, Fundulus notatus, and Notropis cornutus. (G. H. P.)

3558. Egusa, Syuzo. 1958. ON THE OXYGEN CONSUMPTION RATE OF THE POND-CULTURED EEL, ANGUILLA JAPONICA. (In Japanese with English summary) Japanese Jour. Ichthyol. 7(2/4): 49-56; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31306. 1960.

Methods used to determine the rate of O_2 consumption are described. In almost every case it was found that during the early part of the experiment the rate of O_2 intake was high, but that after about 5 hr. it was reduced. Thereafter it remained more or less constant until a lapse of about 15 hr., when it fluctuated widely and irregularly. The steady rate in the middle of the experiment was used as an estimate of the resting rate of O_2 consumption. (M. G.)

3559. Koyama, T. 1958. A STUDY OF THE PRESSURE CHANGE WITHIN THE ORAL CAVITY BY THE NORMAL RESPIRATORY MOVEMENT AND THE SO-CALLED CLEANING MOTION IN CARP. Japanese Jour. Ichthyol. 7 (2-4): 89-94; Biological Abstracts, Vol. 35, No. 12, Abst. No. 31780. 1960.

The so-called cleaning motion was divided into 3 types according to the pressure change and the opercular movement. Removal of the oral valves resulted in nearly a 50% decrease in the pressure change. Removal of the opercular valves did not pro-

duce any remarkable change. The author concludes that "cleaning" is not a suitable word for the motion. The pressure within the oral cavity does not balance with that of the outermedium during normal respiration. (From auth. summ.)

3560. Pickford, Grace E. 1959. ENDOCRINOLOGICAL STUDIES ON THE EURYHALINE KILLIFISH, FUNDULUS HETEROCLITUS (LINN). Yale Jour. Biol. and Med. 31(6): 341-362; Biological Abstracts, Vol. 35, No. 12, Abstract No. 31805. 1960.

A review of 12 years work.

3561. Corkum, Kenneth C. 1959. SOME TREMATODE PARASITES OF FISHES FROM THE MISSISSIPPI GULF COAST. Proc. Louisiana Acad. Sci. 22: 17-29; Biological Abstracts, Vol. 35, No. 12, Abst. No. 33199. 1960.

Sixteen spp. of trematodes are recorded from 18 spp. of marine fishes. (G.H.P.)

3562. Thatcher, Vernon E. 1959. A REPORT ON SOME MONOGENETIC TREMATODE PARASITES OF LOUISIANA MARINE FISHES. Proc. Louisiana Acad. Sci. 22:78-82; Biological Abstracts, Vol. 35, No. 12, Abst. No. 33206. 1960.

Eight spp. of trematodes are recorded from 6 spp. of fishes. (G.H.P.)

3563. Schrader, T. 1958. THERMAL CONDITIONS IN IMPOUNDING RESERVOIRS. Limnol. SchrReihe, 5, No. 21, 68-88; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 618. 1960.

An important difference between impounding reservoirs and natural lakes is that in the former the out-flow is from the bottom and flow over the dam wall is, at least in large reservoirs, rare. From results of investigations in a number of small Thuringian reservoirs and in the two large Saale reservoirs, the author describes conditions of stratification of temperature and oxygen content. The form of thermal stratification is dependent on the relation of the amount of inflow to the capacity of the reservoir and on the temperature of the inflowing water. The greater the inflow the more regular is the decrease of temperature from the surface to the bottom. Withdrawal of water from the bottom affects the distribution of the summer heat; the warm layers sink in a direction parallel to their original position, causing warming of the hypolimnion. The effects of turbine suction and of the recirculation or addition of water for the operation of pumps are described.

3564. Fjerdingstad, E. 1956. DANISH METHOD FOR THE CONTROL OF ALGAE WITH COPPER SULPHATE. Battenhygien, 12, 32-37 (English summary); Water Pollution Abstracts, Vol. 33, No. 4, Abstract No. 736. 1960.

The author describes experiences in controlling algae with copper sulphate in a Danish lake. The quantity of copper sulphate used and the effect of the treatment on the plankton population are shown in a graph. A list of references is given.

3565. Cairns, J., and A. Scheier. 1958. THE RELATIONSHIP OF BLUEGILL SUNFISH BODY SIZE TO TOLERANCE FOR SOME COMMON CHEMICALS. Proc. 13th Industr. Waste Conf., Purdue Univ. Engng Extn Ser. No. 96, 243-252; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 739. 1960.

Experiments were made to determine the tolerance of 3 different sizes of bluegill to some common chemicals, including calcium chloride, potassium cyanide, sodium nitrate, cresol, sodium carbonate, sodium bicarbonate, sodium sulphate, zinc chloride, ammonium chloride, potassium dichromate, potassium chromate, phenol, sodium hydroxide, and hydrochloric acid. The results are given in a table and discussed briefly. For most chemicals there was little difference in the 96-hour median tolerance limits for the three sizes of fish. The most marked differences occurred with calcium chloride and phenol. The pH value also had a marked effect, small and medium-size fish being more tolerant to high pH values and large fish being more tolerant to lower pH values. The size of the fish did not affect the way in which the fish reacted to toxic concentrations nor the period of exposure before response occurred.

3566. Muller, K. 1958. THE INFLUENCE OF TRANSPORT OF WOOD BY WATER ON FISHERIES IN SWEDISH LAPPLAND. Verh. int. Ver. Limnol., 13, 533-544; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 742. 1960.

In Swedish Lappland and North Finland a large part of the wood produced is transported by floating. The author discusses the polluting effects of the wood and concludes, from observations over four flotation periods, that sedimentation of bark or wood particles takes place only in still water and that reduction of the oxygen content by organic impurities is not found in flowing water. Waters are frequently more polluted by fallen trees, branches, and leaves than by flotation. Storage of wood for long periods may cause accumulation of deposits and reduction of oxygen. The effects are then discussed of alterations in the streams made to improve the transport of wood; these include damming, construction of channels, and levelling of the bed by removal of rocks. The main requirements to be observed in alterations made to improve wood floating are that there should be no normal increase in the rate of flow, cleaning of the bed should not be done in long stretches but should be broken by stretches in natural condition, easily eroded banks should be strengthened, and work should be done at seasons which will not affect the spawning and development of the fish.

3567. Stundl, K. 1958. EXPERIMENTS ON THE EFFECTS OF WASTE WATERS FROM WOOD-WORKING INDUSTRIES ON STREAM ORGANISMS. Vehr. int. Ver. Limnol., 13, 507-513; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 743. 1960.

Laboratory experiments on the effect on fish and lower organisms of waste waters from wood-working industries are described and the results are compared

with observations in natural waters. In laboratory experiments the resistance of fish and lower organisms to these waste waters was greater than in streams; this has also been observed by other authors and is ascribed to secondary effects in streams, for example growth and decomposition of fungus, especially in the case of sulphite cellulose waste waters. The effects of acid were more directly comparable. An acid rinsing water, diluted 100 times, caused visible damage to rainbow trout in 10 min. but the fish recovered completely on removal to fresh water. Experiments with paper factory waste waters showed that the total mixed waste waters were harmful only if undiluted. Waste waters from wet processes of bark removal were harmful to fish if undiluted, but damaged fish recovered in fresh water. Waste waters from wood gas generators were toxic to fish even when the contents of phenol were considerably below those given in the literature as lethal; this is ascribed to the effect of accompanying substances and polyvalent phenols. Discharge of these waste waters into a stream where the dilution was such that phenol was not detectable even in traces, affected fish and destroyed lower organisms. The limitations in the use of laboratory experiments for testing the toxicity of these waste waters and the possibility of combined laboratory and stream investigations are discussed.

3568. Mossevitsch, N. A., and A. G. Gussev. 1958. THE INFLUENCE OF WASTE WATERS FROM WOOD TREATING WORKS ON WATERS AND WATER ORGANISMS. Verh. int. Ver. Limnol., 13, 525-532; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 744. 1960.

The authors give, from the literature and from investigations of WNIORH (All-Union Research Institute for Inland Lake and River Fisheries, Leningrad), particulars of the harmful components and characteristics of waste waters from sulphite and sulphate cellulose factories, paper works, and hydrolysis of wood, and discuss their effects on fish and other organisms and conditions in which their discharge may be permitted.

3569. Schrader, T. 1958. CHEMICAL AND BIOLOGICAL EFFECTS OF SULPHITE LYES IN THE LARGE IMPOUNDING RESERVOIRS OF THE UPPER SAALE (THURINGIA). Verh. int. Ver. Limnol., 13, 491-506; Water Pollution Abstracts, Vol. 33, No. 4, Abst. No. 747. 1960.

In the upper Saale a chain of impounding reservoirs has a capacity of about 70 km, and there are only some 9 km of constantly flowing water. The author describes investigations into the effect of waste waters from a sulphite cellulose factory at the head of the Bleiloch reservoir on that reservoir and on the other of the two large reservoirs, the Hohenwarte reservoir. Investigations in 1953-54 are compared with those in 1951. The second investigation, which was made mainly to determine the effect of residual pollution from the Bleiloch reservoir on the Hohenwarte reservoir, took place during a period of extreme low water when the flow of the Bleiloch reservoir was only 38 per cent of the yearly average. The course of the polluted Saale water through the reservoirs and the effects of seasonal stratification and spring and autumn circulation on the distribution of oxygen are described and an account is given of the plankton population of both reservoirs and of the effects of pollution and of the drought period of 1953-1954 on the types and numbers of fish in the reservoirs.

3570. Rosen, A. A., and F. M. Middleton. 1959. CHLORINATED INSECTICIDES IN SURFACE WATERS. Analyt. Chem., 31, 1729-1732; Water Pollution Abstracts, Vol. 33, No. 5, Abst. No. 829. 1960.

In the evaluation of water quality, a single analytical procedure that could be applied routinely to detect a variety of common insecticides in concentrations below those toxic to aquatic life, is desirable. Such a method has now been developed. It involves concentration and recovery by adsorption on an activated carbon filter, removal of other interfering pollutants by chromatography on alumina, and infrared spectroscopy of the recovered insecticites. The method has been found to be sufficiently sensitive to identify less than 0.01 p.p.m. of 8 chlorinated insecticides in river water. The insecticides used were aldrin, benzene hexachloride, chlordane, DDD, DDT, dieldrin, endrin, and methoxychlor.

3571. Gros, C. M., R. Keiling, J. Bloch, and J. P. Vilain. 1958. EFFECT OF X-RAYS ON THE SURVIVAL OF A FISH (CARASSIUS CARASSIUS) EXPOSED TO LOW TEMPERATURE. C.R. Soc. Biol., Paris, 152, 1187-1190; Water Pollution Abstracts, Vol. 33, No. 5, Abst. No. 946. 1960.

Fish acclimatized to a temperature of 3°C were exposed to X-rays at a temperature of 0° and then returned to water at 3°C. Fish which had received doses of up to 10,000r survived as well as did the controls not exposed to radiation. After 50 days the fish were transferred to water at 15°C, and the irradiated fish then died much faster than did the controls.

3572. Wunder, W. 1958. THE DESTRUCTION OF UNDESIRABLE POND PLANTS WITH CHEMICALS. EXPERIMENTS WITH NATA AND UGEX. Allg. FischZtg, 1957, 82, No. 17/18; Water Pollution Abstracts, Vol. 33, No. 5, Abst. No. 950. 1960.

Experiments on the use of the preparations Nata and Ugex for the control of weeds in ponds are described. Both compounds acted on reeds and rushes, but had no effect on floating and submerged plants. They should be used on the bed after emptying of the pond, as damage to fish and other organisms by Ugex has been observed.

3573. Odum, E. P., and R. W. Bachmann. 1959. UPTAKE OF ZINC-65 AND PRIMARY PRODUCTIVITY IN MARINE BENTHIC ALGAE. Biol. Bull., Woods Hole, 117, 421; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1017. 1960.

Abstracts of paper presented at a seminar at the Marine Biological Laboratory, Woods Hole, Mass., 1959. The primary production of macroscopic benthic algae and their rate of uptake of zinc-65 from normal sea water were studied. The results indicated that

the uptake of zinc depends on photosynthetic activity as no uptake occurred in the dark and the rate of uptake in the light was independent of the concentration of the isotope or carrier added to the water. It is therefore concluded that zinc-65 could be used as a tool for measurement of primary productivity.

3574. Mann, H. 1958. DAMAGE TO FISHERIES BY PREPARATIONS FOR DESTRUCTION OF MAYFLIES. Fischwirt, 8, No. 8, 217-220; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1122. 1960.

Application of chemical agents for the destruction of mayflies has led in recent years to large-scale death of fish sometimes through careless application and sometimes through occurrence of heavy rain after application so that the materials are washed into brooks. Poisoned flies falling from trees may also cause damage. The author has studied the toxicity to fish of three such preparations: Forst-Viton (used as an emulsion and as a dusting agent and containing 12 per cent active agent), emulsifiable Thiodan with 20 per cent active agent, and Thiodan dust with 2.5 per cent active agent. The effects of emulsifiable Thiodan and Forst-Viton emulsion were much the same; the toxic concentrations were 0.001 c.c. per litre for white fish, 0.01-0.005 for sludge worms, and 0.005 for water fleas. With both preparations the toxicity was reduced by increasing the concentration of calcium in the water. Mixing the reagents gave added toxicity regardless of the proportions of the mixture. Toxicity was increased by low concentrations of oxygen. Resistance to low concentrations and the possibility of recovery were also studied. White fish and sludge worms could withstand 0.005 g per litre of Forst-Viton dust but Thiodan dust was toxic at 0.001 g per litre.

3575. Marczek, E., and J. Zielinski. THE EFFECT OF SULPHITE WASTE WATERS ON DEATH OF FISH. Gaz, Woda Tech. sanit. 1957, 31, 45-49; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1123. 1960.

Fish in non-aerated sulphite waste waters died in 5-9 hours; slight aeration prolonged the period to 10-16 hours. The sensitivity of different fish is discussed. Mortality in well-aerated waste waters was normal.

3576. Flemming, A. S. 1959. CONTROL OF RADIOACTIVE WASTES. Publ. Hlth Rep., Wash., 74, 883-884; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1126. 1960.

The author reports and discusses the significance of the first enforcement action under the 1956 U. S. Federal Law controlling the contamination of interstate waterways by radioactive waste waters. In the period April 1958-April 1959, the U. S. Public Health Service carried out a survey of the Animas river in southwestern Colorado and northwestern New Mexico which showed that the water contained 40-160 per cent more radioactivity than the maximum permissible concentration, owing to the discharge of waste waters from uranium milling operations at the plant of the Vanadium Corporation at Durango, Colo. Following proceedings under the 1956 Federal Law, the Corporation are now required to reduce the radium content (both soluble and insoluble) of the waste waters to the minimum it is possible to achieve by known methods, before discharge to the river. Although about 30,000 people use water from the Animas river, the situation was brought under control before the population had ingested amounts of radioactive material sufficient to cause detectable damage to health. During the survey of the river, a scarcity of fish and other aquatic fauna was noted and found to be due to a number of toxic chemicals which were also contained in the waste waters from the plant of the Vanadium Corporation; the toxic chemicals will in future be recovered before the waste waters are discharged to the river. During 1960, the U.S. Public Health Service intends to begin studies on the radioactivity in 3 rivers in Wyoming (the Bighorn, Sweetwater, and North Platte rivers).

3577. Foster, R. F. 1959. THE NEED FOR BIOLOGICAL MONITORING OF RADIOACTIVE WASTE STREAMS. 5th Nuclear Engng Sci. Conf., Cleveland, Ohio, 1959, Preprint V-6. 20 pp.; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1127. 1960.

In evaluating the radiation exposure which man receives from an environment that contains radioactive wastes, it is important to consider not only drinking water but all sources which may contribute to the total exposure. If radiation exposure arising from radioactive wastes in surface waters is computed from discharge rates, it may be either over- or under-estimated, as radioactive materials may be lost from water by processes other than decay, while diluted isotopes may be reconcentrated on bathing beaches, in algal growths attached to boat bottoms, and in edible fish. Concentration factors differ for different waters, and it is therefore considered important to include appropriate biological forms in any monitoring programme as their contribution to the total exposure may exceed the contributions from other sources.

3578. Hoak, R. D. 1959. PHYSICAL AND CHEMICAL BEHAVIOUR OF SUSPENDED SOLIDS. Sewage industr. Wastes, 31, 1401-1408; Water Pollution Abstracts, Vol. 33, No. 6, Abst. No. 1132. 1960.

The author reviews the polluting effects of suspended matter in streams, whether it originates from natural sources or is of municipal or industrial origin. Its principal effects are interference with self-purification by reducing photosynthesis and by smothering benthal organisms; damage to fisheries by direct effects on the fish themselves and by destruction of spawning grounds; and the unsightliness of discoloration. Long-term experiments are now being carried out by the steel industry to evaluate the effect of suspended matter discharged in its waste waters. Preliminary laboratory experiments on the behaviour of a suspension of flue dust particles discharged through a straight rectangular flume showed that, contrary to the expected results, the amount of settling with laminar flow

was less than when the flow was turbulent. It was obvious, however, that agglomeration of particles had occurred, and it is probable that turbulence, which increased the opportunity for contact, caused the agglomeration that resulted in an increase in the rate of settling. Dye studies showed that, at all water velocities used, a band of dye of greater concentration than the average flowed along the centre of the bottom of the flume, illustrating the fact that much of the total sediment load of a stream tends to flow on the bottom of the channel.

3579. Nose, Yukio. 1959. AN EXPERIMENT ON THE FIN-CLIPPING METHOD FOR ESTIMATING THE POPULATION SIZE OF EEL IN A CULTURE POND. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 25, No. 4, pp. 275-281.

The number of eel, Anguilla japonica in a culture pond (about 1 acre) was estimated by Petersen mark-and-recapture method, and the estimates which were obtained from the first set of data and that of the first and second sets of data, treated as a whole, were compared with the actual number of eel captured after the draining of the pond.

The results indicated that the estimates were greater than the actual number of fish and the source of error was mainly attributable to misjudging some of the marked fish for those that were unmarked, which is caused by the rapid regeneration of the clipped fin in some of the marked fish. (From auth. abst.)

3580. Kusaka, Takaya. 1959. STOPPING EFFECTS OF ELECTRIC FISH SCREEN. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 25, No. 4, pp. 269-274.

Fish used were 10 Carassius auratus and 10 Oryzias latipes in fresh water, and 12 Sphaeroides niphobles in sea-water.

Two electrodes are set in the upper and lower sides at the center of tank, and were closed alternate electric current of sine wave of 50 cycles regulating its voltage and amperage by transformers.

Frequencies of fish individuals pass through the center of tank were compared on cases closed and off the electric current.

In general, stopping effects of electric current in fresh water is about 50%, and in sea-water is about 20%. Also, sea-water required several hundred times of amperage than fresh water. (From auth. abst.)

3581. Taguchi, Kisaburo. 1959. STUDIES ON THE ESTIMATE OF THE DISTRIBUTION DENSITY OF SALMON POPULATION ON THE HIGH SEAS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 25, No. 5, pp. 335-341.

In order to estimate the distribution density of salmon on the high seas, the number of tangled fish per one shackle of gill-net in one trial of test fishing by one vessel is used as an index showing the density of the salmon distribution.

But the fishes tangled to the net are not necessarily distributed equally in all parts of the nets, and also it is unknown whether or not the fish are distributed equally around the test fishing area.

Then the distribution of the number of fish tangled to each one shackle of one set of gillnet and the distribution of the number of fish caught by several vessels in certain limited area in the same time were studied.

The results obtained from this experiment are as follows:

1. In a test fishing, at least 100 shackles (unit - "Tan" with a length about 50 meters) of gill nets must be used.

2. The probability to estimate the distribution density of salmon by the average number of tangled fish per one shackle of gill-net in one trial by one vessel is in low level.

Table 1 shows that the number of fish tangled to each shackle of one set of gillnet forms a Poisson distribution.

Table 2 shows that in a round area with a radius of about 40 miles salmon population distribute in a form of Poisson too. (Auth. abst.)

3582. Yasuda, Hideaki. 1959. IMPLICATION OF THE SCALE RING--III. IMPROVEMENT OF AGE-DETERMINATION FOR FISHES. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 25, Nos. 7-9, pp. 505-509.

In judging the age of a fish, it has been customary to resort to the frequency of those rings among many individuals of the fish which are intuitively chosen as annual ring from the rings observed on the scale, the vertebra or otolith. Consequently, this has necessarily led to results not free from personal errors.

The author, now recording the frequency of any rings detectable at all on the scale for uniformly sized individuals of a fish to be examined, tries to establish a standard procedure for objectively estimating the age of the fish. By means of this new design it was revealed that the Euthyopteroma virgatum (H.) the chance of ring formation is provided in two seasons every year (while most individuals of this fish form (only two) rings per year.). (Auth. abst.)

3583. Ken-ichi Kashiwada, Daiichi Kakimoto, Akio Kanazawa, Toshiro Kuroki, and Koji Nozawa. 1959. STUDIES ON VITAMIN B_{12} IN LAKE IKEDA AND RIVER KOTSUKI. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 25, No. 10-12, pp. 652-657.

In the work reported here the vitamin B_{12} content and its variation in lake and river water was measured.

In May 1958, the vitamin B_{12} content in the water of Lake Ikeda, measured by the Euglena method, was very small (e. g. less than 1 mγ/l) and no distinct variation in the vertical and horizontal distribution was observed. However, in August, the vitamin increased in content more than twice as much as that of the spring value, the vertical distribution showed a close correlation with the quantity of dissolved oxygen and the maximum was shown at the depth of 20m. Fish schools were also observed in this region. Similar seasonal change in vitamin B_{12} content was found in water from Kotsuki River, with a low spring level

(about 0.1 mγ/l) and a high autumn level (0.4~4.5 mγ/l). And in the river water, high level of vitamin B_{12} was observed in the morning, and in the daytime the vitamin content decreased with the lapse of time. It was found also that considerable amount of vitamin B_{12} poured into the river water from the banksoil with the rain water.

3584. Kobayashi, Kiichiro, Shuzo Igarashi, Yuji Aiiko, and Koji Hayashi. 1959. STUDIES ON AIR SCREEN IN WATER. Bulletin of the Faculty of Fisheries, Hokkaido University, Vol. 10, No. 3, pp. 222-228.

Perforated pipes, 10-15mm dia., were set in a tank and air was pumped into the pipes by the compressor; air bubbles spouted out through the holes to make a white curtain.

Various type air curtains were produced by changing diameter of holes, intervals of holes and air pressures. The fishes used were about 30 individuals of "Medaka", Oryzias latipes, of average 3cm total length and 37 individuals of "Funa" Carassius carassius of average 9.5 cm total length. The experimental tank was of wood painted white inside.

The results of these observations proved that:

1. An air screen has considerably intercepting effect.
2. When the fish school was enclosed in too small an area formed by an air screen, the intercepting effect of curtain was diminished by energetic circulation of water caused by rising up of air bubbles inside the air screen.
3. A school of fish has a similar comparative behavior to both an air curtain and an ordinary conductive net, for instance, when the intervals of holes in the pipe corresponded generally to the mesh size of the ordinary conductive net. (Auth. abst.)

3585. Yamada, Juro. 1959. ON THE VITELLINE SYNCYTIUM AND THE ABSORPTION OF THE YOLK IN THE FRY OF TWO SALMONIDS. Bulletin of the Faculty of Fisheries, Hokkaido University. Vol. 10, No. 3, pp. 205-210.

The process of yolk absorption in the hatched fry of dog salmon and rainbow trout was traced mainly by means of histological observations of the yolk-sac. The yolk is enclosed by vitelline syncytium in which are distributed many vitelline veins which are contributing to absorb the yolk. The veins often lack their endothelium, and the syncytium is continuous to the blood at that portion. The syncytium has several large vacuoles which are considered to be filled with some fatty substance.

After the disappearance of the yolk-sac, the yolk mass remains for a considerable period in the abdominal cavity of the fry, and it finally consists practically of syncytium only. The vitelline nuclei migrate towards the veins into which they liberate their contents. Three happenings can be distinguished based on the behaviour of the nuclei; the direct destruction of the nuclei at the endothelium-less portion, the liberation of nuclear substance at a slightly distant portion from a vein, and the liberation at the outside of the endothlium. After the nuclear contents have been liberated, the sites are consequently vacuolized. Then, the vacuoles are filled with blood cells. In such a way, the vitelline syncytium is increasingly invaded by the veins. (Auth. summ.)

3586. Hayashi, Shigeichi, and Mitsuru Kitahara. 1959. A NOTE ON SCALES OF THE COHO SALMON. Bulletin of Tokai Regional Fisheries Research Laboratory, No. 26, November, 1959, pp. 7-20.

Examined in this study were scale characters as well as fork length, body length, body weight, head length, body depth and sex ratio of the coho salmon.

Scales from different body parts varied in size and relative lengths of the winter bands but not in number of the bands. Scale reading indicates that almost all the fish under study appeared to be in the third year inclusive of one year in fresh water. The exceptions are one fish which seems to have spent two years in the sea after leaving the river in the first year of life, and ten individuals in the fourth year having two years of fresh-water life.

From examinations of fork length, it was suggested that environmental conditions of the nursery grounds differed between the two years. Significant difference between stations was noted in fork length, head length, and body depth of the fish captured during the 1954 season.

Relationships of fork length with body length, body weight, head length or body depth were determined. No sexual dominancy was noted. (Auth. summ.)

3587. Tyler, John E. 1960. RADIANCE DISTRIBUTION AS A FUNCTION OF DEPTH IN AN UNDERWATER ENVIRONMENT. Bull. Scripps Inst. Oceanography, Vol. 7, No. 5, March 1960, pp. 363-412.

From the physical point of view the spatial distribution of radiance at various depths underwater provides by far the most useful description of the light field. From detailed radiance distribution data of this kind it is possible to obtain many of the important optical constants of the water and to make predictions regarding the penetration of light through water. For the purpose of checking theoretical relationships, and of designing and checking instrumentation, and for many other purposes, it is not important whether the water studied is fresh or salt, turbid or clear, since these parameters influence only the magnitudes of the quantities and constants involved.

In this investigation it was important that the water sample be deep and homegeneous throughout, and that the band width of radiation employed be narrow and consistent with depth. A detailed description of the experimental location establishes qualitatively or quantitatively the influence of various factors such as water depth, sky conditions, water surface conditions, water homogeneity, etc., on the data. Tables of radiance distribution data are given for seven depth stations under clear sunny conditions and for five depth stations under overcast conditions. The treatment of the original data to eliminate the effects of ambient light-level changes, changes in the position of the sun, etc., and to obtain tables based on a single sun altitude is discussed in detail.

The limiting shape of the radiance distribution, predicted by other workers and referred to here as the asymptotic radiance distribution, is discussed and tables of radiance K values are given. These latter data can be used to follow the changes in shape of the radiance distribution and to extrapolate these changes to even greater depths. (Auth. abst.)

3588. Sharonov, I. V. 1958. SEVAN PISCICULTURE UNDER CONDITIONS OF LAKE DRAINAGE. (SEVANSKOE SYBOVODSTVO U USLOVIIAKH SPUSKA OZERA.) M., Rybnoe Khoziaistvo, No. 8, August, pp. 31-34.

Lake Sevan is the largest high-altitude reservoir of Transcaucasia. Withdrawing water for irrigation has caused the water level of the lake to be lowered by 11 m. and its surface area to be reduced from 1416 km^2 to 1329 km^2.

Lake drainage affects the habitation of aquatic animals and plants in the lake. The drying of the upper section of the littoral zone has upset former spawning grounds and disrupted natural reproduction and supply of fish, and catches are correspondingly low.

Level drop in the lake has been intensive and the formation of new spawning grounds is slow. To maintain fish supply in Lake Sevan on the former level, artificial fish production has been in operation since 1923. Between 1923-1936, 26.3 million trout larvae were planted annually in Sevan tributaries, during the years of 1938-1942, 57.6 million larvae were introduced, and from 1945-1956, two fisheries have annually incubated 70.3 million trout eggs, so that 80% of the present supply is maintained by artificial measures. (R. G. K.)

3589. Denisova, A. E. 1959. IS FISH STRANGULATION POSSIBLE IN THE KAKHOV RESERVOIR? (VOZMOZHNY LI ZAMORY RYB V KAKHOVSKOM VODOKHRANILISHCHE?) M., Rybnoe Khoziaistvo, No. 2, Feb., pp. 27-30.

Kakhov reservoir is one of the largest in USSR. In 1956, workers in the fishery have called attention to mass fish kills of pike perch, Abramis brama, Cyprinus carpio and others, and suspected oxygen deficiency to be the cause of it.

In 1956-1958 experiments were conducted to check the oxygen regime in the Kakhov reservoir, including bays, open stretches, deep and shallow pools. Experimental data showed that in the spring of 1956, dissolved oxygen in the reservoir reached 80-90% saturation, with small stratification in lower layers and bays. In August of the same year, in the upper layers and in calm weather oxygen saturation was up to 200%. In bottom layers and in newly-flooded soil, where organic matter was being oxidized, oxygen saturation was 4-7 mg/lit. (40-75%).

Fish reaction to the content of dissolved oxygen in water varies. Abramis brama begin to be uncomfortable when oxygen content is 2-2.5 mg/lit. and at 0.4-0.6 mg/lit. the fish perish. A similar reaction is shown by roach, pike, and perch. Some forms of carp tolerate a low oxygen content.

The oxygen regime of the Kakhov reservoir has been satisfactory even during the first few years of its existence. Fish kills observed in the reservoir were evidently due to other reasons (epizootic condition, poisoning or other). Mass fish kills in the Kakhov reservoir due to oxygen deficiency are impossible. The entire water mass is renewed three times a year. The reservoir is located in a most favorable place, where throughout the year there is an oxygen regime conducive to healthy fish life. (R. G. K.)

3590. Soong, M. K., and A. B. O. Merican. 1960. THE USE OF ENDRIN AS A PISCICIDE IN MINING POOLS AND FISH PONDS IN MALAYA. Proceedings, 8th Session, Indo-Pacific Fisheries Council, Food and Agriculture Organization of the United Nations, Dec. 6-22, 1958, pp. 19-25.

There is an urgent need among fish culturists in many areas of the Indo-Pacific Region for a cheap and efficient piscicide, especially in dealing with large bodies of water such as disused mining pools which are often many acres in extent and 10 to 30 feet deep. Endrin used in the form of an emulsifiable concentrate has been found to be most useful in Malaya. The recommended dosage is 0.008 p.p.m. in terms of endrin. Used at this concentration, it is found to be much cheaper than the two well-known and widely used piscicides, namely, tea-seed cake and derris root. Moreover, fish poisoned at this concentration of endrin has been found to be fit for human consumption. (Auth. abst.)

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R. M. Chew
C. C. Davis
R. W. Dexter
Harry K. Dupree
I. G. Gellman
M. Grey
R. G. Klein
M. S. Laverack
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